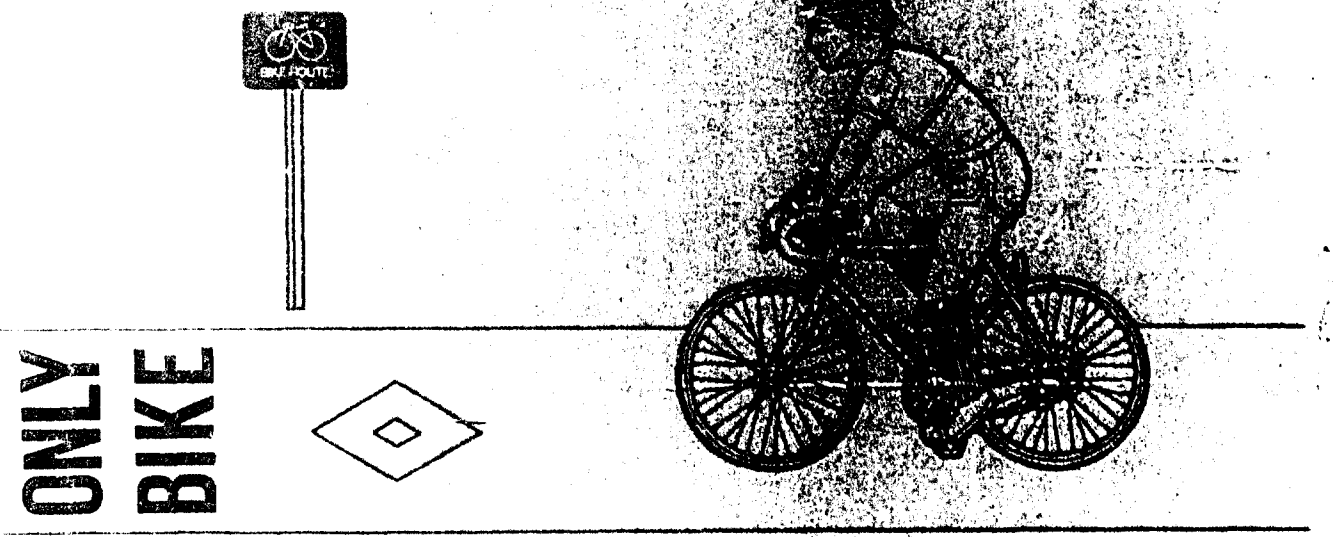
COMMUNITY IMPACT PLANNING REPORT
TRANSPORTATION

VOLUME 3—SOUTH CHEYENNE BIKEWAY PLAN



VOLUME 1—Laramie County Transportation Plan
VOLUME 2—Cheyenne Impact Corridor Plan
VOLUME 3—South Cheyenne Bikeway Plan

AVIX Engineers Architects Planners
December 1984

Air Force
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(HQ USAF/CEVP)

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FINAL REPORT

SOUTH CHEYENNE BIKEWAY PLAN

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City of Cheyenne, Laramie County
Wyoming Highway Department

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December, 1984

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1.0 Introduction

1.1 Project Background

The South Cheyenne Bikeway/Pedestrian plan was completed as part of the transportation impact planning associated with the Peacekeeper Missile system. The plan anticipates that the South Cheyenne area will grow substantially as a direct result of the Peacekeeper project. The subsequent increased demand for non-vehicular travel requires upgrading of neighborhood bicycle and pedestrian facilities, guidelines for which are addressed herein.

In 1975, the City of Cheyenne developed a city-wide bicycle plan through the Cheyenne-Laramie County Regional Planning Office. That plan laid the groundwork for facility design standards and desirable service corridors within the City. A large portion of the plan has been implemented by the City based on a study performed by CSSA and Wirth Associates in 1977. The study designed a bikeway system that is currently used throughout a large portion of the Cheyenne metropolitan area.

The South Cheyenne Bikeway Plan briefly evaluates the effectiveness of the operational bikeway system and presents a network which serves the City south of the Union Pacific Railroad.

1.2 Plan Objectives

The primary objective of the bikeway/pedestrian plan is to design a network to serve non-vehicle travel in South Cheyenne. This design requires evaluation of existing conditions, research of bikeway system standards and development of an improvement and implementation program.

Evaluation of existing conditions began with a reconnaissance of the operational portions of the bikeway system. This was supplemented by discussions with City staff and knowledgeable citizens within the community (refer to Appendix A) to define specific design requirements in Cheyenne. Land uses were studied to determine those areas likely to produce or attract bicycle trips. Streets and sidewalks were also evaluated to determine their potential for use as bikeways.

Research of bikeway system standards included study of those standards used in Cheyenne today. In addition, the California Department of Transportation (Caltrans) "Highway Design Manual - Bikeway Planning and Design" was used extensively and is referenced in the text (refer to Appendix B). The Caltrans Manual was completed in 1983 and contains a wealth of information on planning and design criteria. The Greeley Comprehensive Bicycle Plan, completed in 1979, is another extensive document that was used as a reference to develop evaluation criteria.

Development of the improvement and implementation program takes into account the funding constraints of a tight economy. A large portion of the proposed bikeway system in South Cheyenne is planned to utilize the existing roadway system. However, certain key construction projects are necessary to develop the system properly. These are discussed in Section Three.

A bikeway system must either share roadways with motor vehicles or supplement the road system by development of exclusive off-street bicycle corridors. On-street bikeways can be efficiently developed to enhance safety and convenience, particularly if implemented in connection with other required street maintenance and improvement activities. Eliminating street irregularities, frequent street sweeping and upgrading intersections to avoid potential conflicts are activities which help vehicle traffic flow and also encourage increased bicycle usage. Off-street bikeways provide an additional measure of safety for users. This is especially desirable when the users are younger or inexperienced bicycle travelers.

A properly planned bikeway system can provide a direct and continuous network which offers a safe environment for pedestrians and bicyclists. This can be an effective method of encouraging walking and biking for transportation and recreation. This report concentrates on planning and design of bikeway capital facilities, and does not address operational considerations such as promotion of safety programs, construction of protected storage facilities and development of a consistent enforcement program. However, these elements are necessary to achieve a truly effective bicycle program. Development of well-conceived bikeways can have a positive effect on bicyclist and motorist behavior. Conversely, poorly conceived bikeways can be counter-productive to education and enforcement programs. Many of the common problems are related to improper bicyclist and motorist behavior and can only be corrected through effective education and enforcement programs.

1.3 Study Methodology and Evaluation Criteria

Use of portions of the existing street network to provide bikeway facilities represents one of the most cost effective means of developing a safe, convenient bikeway network. The use of existing streets, wherever feasible, will generally provide the bicyclist with the most direct and convenient access available. It should be noted that the overall responsibility to maintain adequate levels of safety does not necessarily imply an equal responsibility to maintain or improve current levels of motor vehicle accessibility. Development of bicycle facilities will, in some instances, reduce a corridor's vehicular capacity. The extent to which the objective of maintaining/improving motor vehicle accessibility is incorporated into bicycle facility improvement decisions should be an independent determination in each individual project.

Project evaluation involves fitting the bicycle facility to the particular environment. The alternative designs include:

- Bike Route - provides for shared use with pedestrian or motor vehicle travel.
- Bike Lane - provides a striped lane for one-way bike travel on a street or highway.
- Bike Path - provides for bicycle travel on a right-of-way completely separated from any street or highway.

The evaluation procedure can be broadly divided into three phases. This plan is primarily concerned with Phases I and, to a lesser extent, Phase II.

Phase I - A rapid, initial assessment of major bicycling corridors to subjectively determine the general implications of bikeway development in street corridors.

Phase II - A detailed, objective evaluation of selected conditions on alternative routes within a corridor to determine the feasibility of specific bikeway improvements.

Phase III - Implementation of specification such as signing and marking shoulder widening, or construction of a bike path.

Phase I - Preliminary Assessment of Corridors

A logical first step in the design of bikeway facilities is to identify general corridors through which bicycle travel is likely to be greatest, and provision of bicycle facilities is likely to be warranted. Analysis of area riding environment and bicycle user information helps to identify corridors satisfactorily on a subjective basis.

Two key factors are important in identifying bicycle corridors:

1. Most generators and attractors are similar for motorists and bicyclists. Therefore, primary motor vehicle travel corridors are also candidate bicycle corridors.

2. Traditionally, bicyclists will not divert to bikeway facilities which are more than two to four blocks distant from their desired travel path.

With these considerations in mind, existing streets within selected corridors can be readily evaluated through a brief review of the following criteria:

1. Traffic volumes
2. Vehicle operating speeds
3. Pavement width
4. Route continuity
5. Route amenity
6. Grade conditions

Any route can be reasonably evaluated on a qualitative scale by considering these criteria.

Phase II - Detailed Assessment of Corridors

Having identified a basic corridor through which bikeway facilities may be logically provided, the final decision to select and implement a proposed bikeway improvement should be made based on a detailed examination and evaluation of the following factors:

1. Volume and capacity conditions and levels of service on candidate streets.

2. Clearance conditions, compared to general guidelines on width and clearance requirements for various bikeway facilities.

3. Potential magnitude of cross-traffic conflicts.

4. Automobile parking conditions and adjacent land uses.

5. Other secondary factors:
   a. Bicycle volumes
   b. Pavement condition
   c. Sight distance
   d. Truck traffic
   e. Bus routes
   f. Drainage grates
   g. Amenities (shelters and services)
   h. Attractions
   i. Night time illumination

Each of these factors, along with brief guidelines for their application, are discussed below. In general, selection and implementation of any type of bikeway facility should be based on a complete evaluation involving all factors. However, one or two of these factors are of substantially greater importance than the others when considering specific types of bikeway improvements. For example:

- Bike Routes
  Traffic volume conditions and motor vehicle speeds are the key considerations in assessing the feasibility of bike routes.

- Bike Lanes
  Volume conditions along with width and clearance factors are the key considerations in assessing the feasibility of striped bike lanes.

- Bike Paths
  Pavement width (right-of-way width) and the number and frequency of cross traffic conflicts are the principle factors in establishing the feasibility of bike paths.

Volume and Capacity Conditions

The quality and character of motor vehicle traffic flow is one of the primary determinants affecting the choice of on-street bikeway treatments. This factor is important because when drivers begin to experience delays, they will search for alternate lanes or routes. They are likely to encroach into adjacent areas intended or designated for bicycle use. Figure 1 shows the relationship of motor vehicle speed and traffic volumes to bikeway facilities.

Clearance Factors for Bikeway Development

The combination of minimum dimensions of the bicycle and rider "envelope" and minimum clearance and maneuvering space define the overall width requirements necessary for comfortable bicycle operation relative to adjacent stationary or parallel moving objects. By incorporating

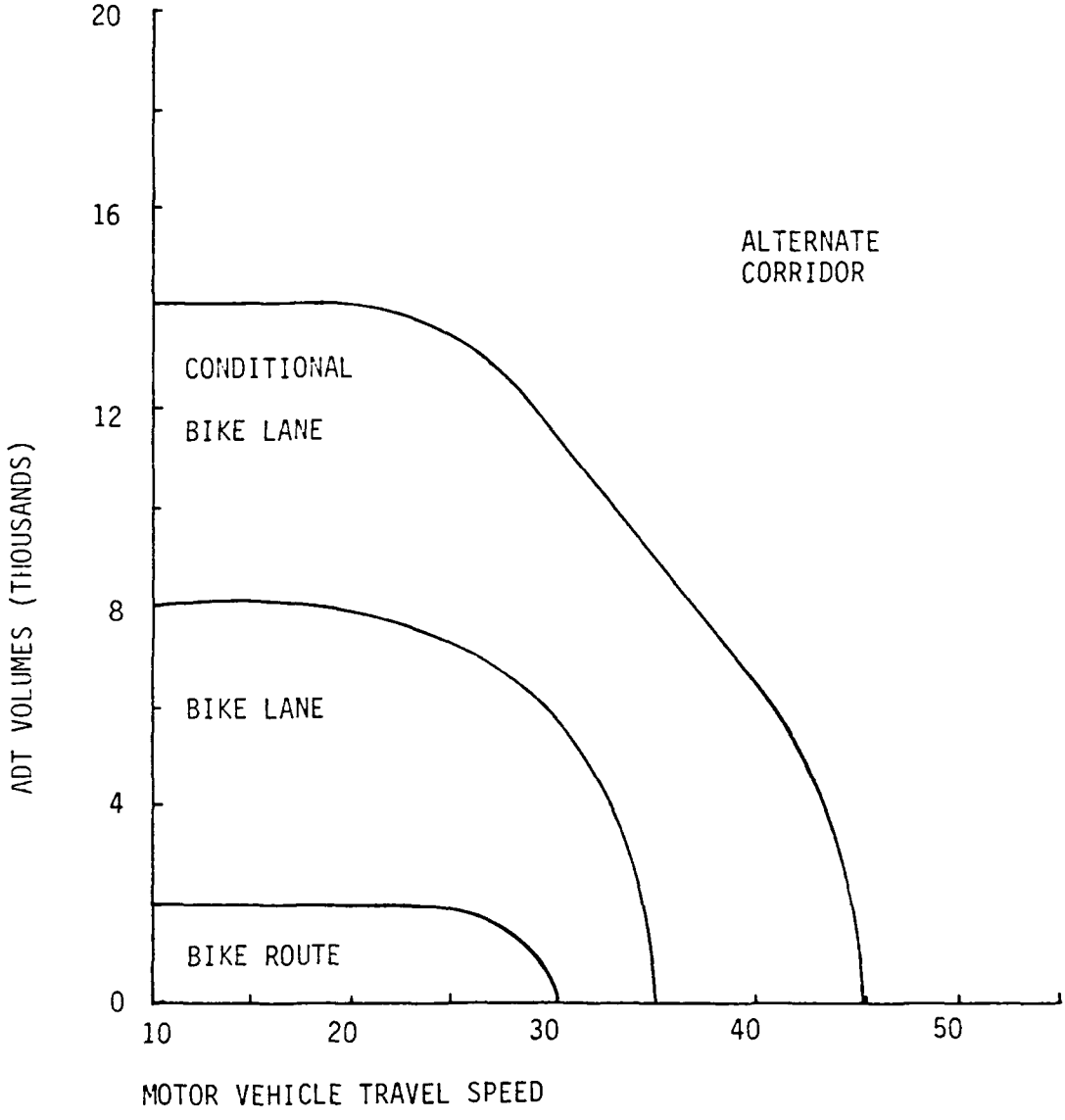


Figure 1
RELATIONSHIP OF MOTOR VEHICLE SPEED
VOLUME TO BIKEWAY REQUIREMENTS

varying motor vehicle speeds, it is possible to identify general clearance guidelines necessary for the development of various types of bikeways. Figure 2 illustrates current standard width and clearance requirements for bicycle operation. In addition, an empirical relationship is suggested which directly expands these clearance requirements with respect to motor vehicle speeds, thus suggesting overall pavement width guidelines for various types of bikeway improvements.

To provide appropriate width for Bike Lane and Bike Route development, any of several alternate treatments can be used:

1. Excess lane width on existing streets.

2. Elimination of parking lanes or prohibition of parking during peak travel periods.

3. Upgrading (for traffic and maintenance purposes) of selected roadways.

4. Conversion of shoulder or boulevard areas to bicycle use as a part of existing roadways.

Cross Traffic Conflicts

As mentioned previously, the nature and importance of cross traffic conflicts varies depending on the type of bikeway facility being considered. Though intersection or intersection-like situations pose potentially major hazards on all types of bikeways, the general level of hazard will vary.

- Bike Routes
  Because these facilities are intended for low traffic volumes, they experience limited potential conflicts with low volume cross movements. The relative importance of cross traffic conflicts is less than on other bikeway facilities.

- Bike Lanes
  Because Bike Lane development is partially required to compensate for higher traffic volumes, hazardous intersection situations will be more frequently encountered. Bike Lanes, particularly protected lanes, are significantly more sensitive to cross-traffic conflict conditions than are Bike Routes.

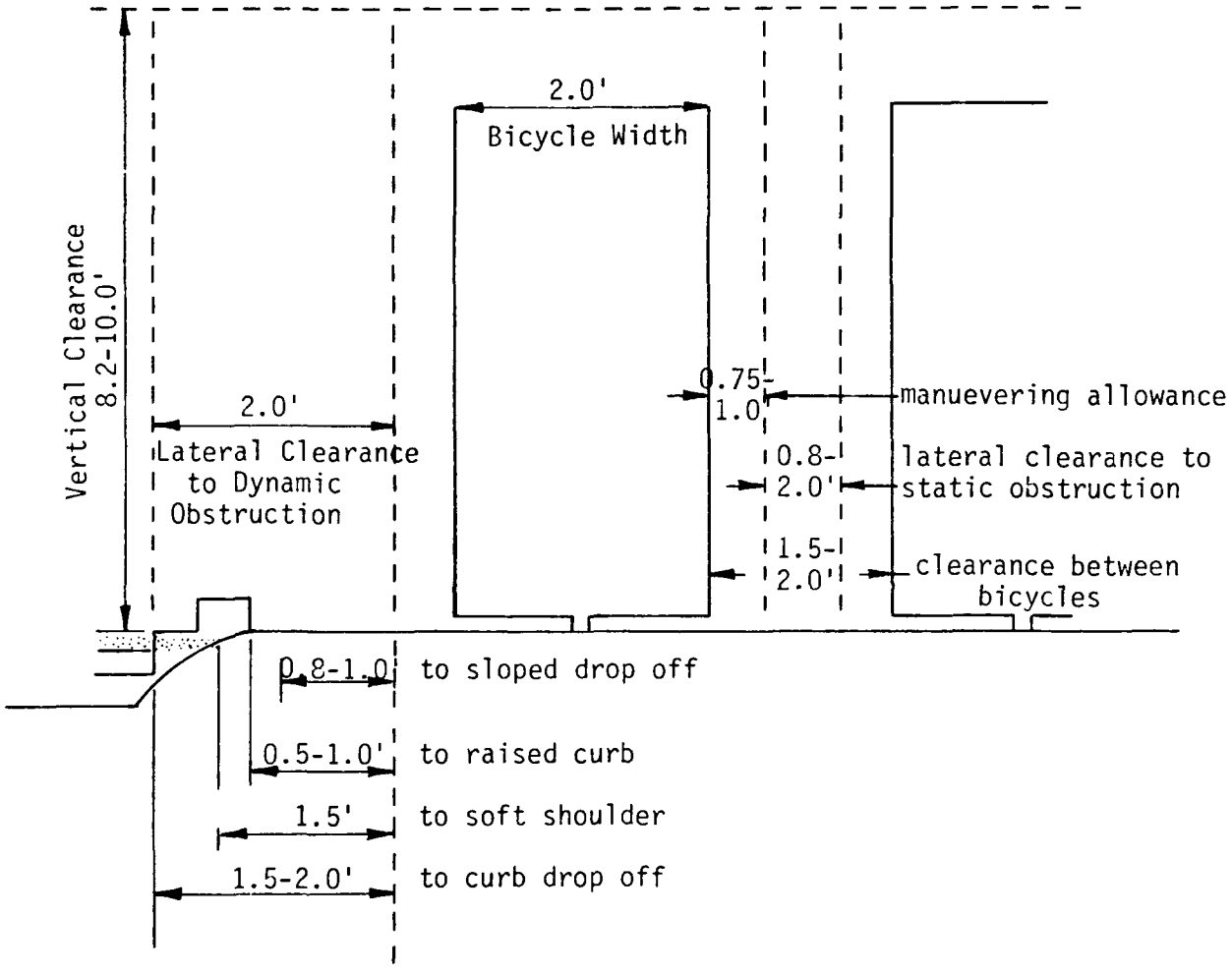
- Bike Paths
  Because paths are located off-street, the associated safety problems are generally focused in locations where cross traffic conflicts occur. The most critical relationship in assessing the effect of potential cross traffic conflicts in Bike Path development is that as the number and complexity of activities and necessary reactive responses increase, the level of hazard rises significantly.

Parking Conditions

Street layout including number of lanes, presence and use of on-street parking, and special channelization and turn lanes, is also of major concern in establishing bikeway feasibility. Typically, the presence of significant channelization and turn lanes indicates that traffic

Figure 2

MINIMUM AND DESIRABLE
CLEARANCE STANDARDS



NOTE: 1 foot = 0.305 meters

volumes are too high to consider on-street Bike Route development. Conditions such as frequent right turns or continuous through traffic movement, pose substantial hazards and should be noted in the street rating and evaluation.

Removal of parking is one way to make available necessary pavement width on streets where traffic volumes and adjacent development preclude establishing other types of bikeways. However, duration, purpose and occupancy conditions of on-street parking on candidate streets should be considered before removing parking.

Other factors which measure the ability and feasibility of various streets and roadways to accommodate on-street bikeway facilities were previously noted and should be considered as appropriate.

2.0 Bikeway System Standards

2.1 Service Objectives

The primary objectives of this bikeway planning study are to provide improved service, as measured by:

- Accessibility - provision for direct and continuous travel between important generators and attractors.
- Safety - development of facilities which protect the inexperienced cyclist.
- Environmental considerations - enhancement of trip quality, as perceived by the cyclist.

Enforcement and security must be considered in development of a fully integrated bikeway system, as part of the operations and maintenance function.

Accessibility

The first priority is access. It is important that bikeways go where the bicyclist wants to go. If they do not, then no matter how safe, the facilities will rarely be used. High priority for bikeway accessibility is not necessary in neighborhoods since trips are casual and have widely varied purposes. Also, trips that occur on local streets require minimal protection from traffic. Local streets are not recommended as bikeways. This plan focuses on the arterial and collector streets, where the need for protection is greater, where increasing numbers of bicyclists face greater danger from motorists, and where more direct access can be provided to destinations for numerous bicycle trips. Traditionally, the primary bicycle trip purposes are recreational, school related, work related and personal business. Trip volumes for all these purposes should increase as accessibility is improved.

Safety

The second priority is safety. A bikeway which provides good access must also be made safe for bicycle use. Relative danger of a street can be determined by considering: vehicle traffic volume, bicycle accident patterns, frequency of street intersections, posted speed limits, and

streets most used for bicycle travel. A strong correlation exists between high auto traffic volumes, high bicycle traffic volumes and frequency of accidents. School related trips are particularly sensitive to safety.

Environmental Quality

The environment in which bicyclists operate affects the level of bicycle activity. The bicycle environment includes air quality, weather, and road surface quality and hazards.

The amount of exposure to air pollutants by a bicyclist is a function of the work effort exerted in riding. Bicycling or other forms of exercise will increase the intake of pollutants to the lungs. Prior to developing urban bikeways, air pollutant levels of proposed bikeway locations should be determined. This should be done even though average community levels are low, since curbside conditions can be high. The Federal standard of 35 ppm for one hour should not be exceeded as an exposure limit.

Extreme cold, rain or snow, extreme heat and significant prevailing wind are climatological elements which directly affect cycling. These conditions can singly or in combination adversely affect bikeway activity. On the whole, the climatological conditions for the Cheyenne area are favorable for bicycling over much of the year and do not adversely affect bikeway potential.

The quality of the riding surface affects bicyclists more than motorists. Bicycles have limited capabilities to absorb the shocks of rough road conditions. Large cracks, rough surfaces and chuck holes can be hazardous to bicyclists. Other problems encountered are railroad tracks, rain gutters and drainage grates. Debris, and particularly sand and gravel, accumulates at the right hand side of the roadway, causing a significant problem for bicyclists.

2.2 Construction Standards

The structural section of a bikeway should be designed in the same manner as a highway, with consideration given to the quality of the base and the anticipated loads the bikeway will experience. Principal loads will normally be from maintenance and emergency vehicles.

A minimum pavement thickness of 2 inches of asphalt concrete and 4 inches of base with soil sterilant is recommended. Asphalt concretes with 1/2 inch maximum aggregate and medium grading are recommended. Consideration should be given to increasing the asphalt content to provide better bonding and increased pavement life. The problem with asphalt bikeways is that the bicycle traffic alone does not generate enough weight to keep the surface active and resilient. Concrete bikeways have longer design lives than asphalt sections. A 4" thick section of concrete will provide sufficient strength to support most maintenance vehicles. Therefore, concrete is recommended as a construction material even though the riding characteristics are not as good as those on asphalt.

2.3 Design Standards

Development of bikeways should not be considered unless a full commitment can be made to design and construct the facilities to meet or exceed minimum design standards. Whether facilities are for recreation, utility purposes, or both; and whether they are to serve children or adults, or both, proper development is of prime importance. Properly designed facilities can accommodate bicyclists of all levels of skill (except, of course, those without basic skills). An improperly designed facility can be a problem to even the most skilled bicyclist. If reasonable standards cannot be met, bicyclists may be better served without the facility. As experience has shown, a poorly conceived and poorly designed facility will frequently not be used by bicyclists. A facility that is not used may be considered a waste of public funds.

The design standards are intended to be a guide to illustrate how existing road systems may be supplemented with facilities to enhance the safety and feasibility of bicycle travel. Experience and research in this area is limited, thus in some instances the standards are based on theory, analysis and judgement.

Most geometric features of Bike Routes and Bike Lanes, including design speed, sight distance, alignment, etc., are the same as for the highway of which these facilities are a part, and thus are adequate. The standards for Bike Paths should be considered where applicable, in the establishment of Bike Routes and Bike Lanes.

FIGURE 3
SUMMARY OF BIKEWAY
CROSS-SECTIONAL REQUIREMENTS

Bicycle Facility

Type	Minimum Width	Use	Location
Bike Path	5'*	One-way travel	Off-street
Bike Path	10'	Two-way travel	Off-street
Bike Lane	4'	One-way travel	Next to curb
Bike Lane	5'	One-way travel	Outside of curb-side parking
Bike Route	14'-15'**	One-way travel	Next to curb or parking lane

Note: 1 foot = 0.305 meters
*Allow sufficient width for maintenance vehicles.
**Includes traveled roadway width, for vehicle lane adjacent to Bike Route

Bike Paths

Bike Paths are facilities with exclusive rights-of-way, with cross flows by motorists minimized. Bike Paths can be described as serving the exclusive use of bicycles and pedestrians. However, experience has shown

that if significant pedestrian use is anticipated, separate facilities for pedestrians are necessary to minimize conflicts.

Sidewalk facilities are not considered Bike Path facilities because they are primarily intended to serve pedestrians, generally cannot meet the design standards for Bike Paths, and do not minimize motorist cross flows.

Widths

The minimum paved width for a two-way Bike Path shall be 10 feet. The minimum paved width for a one-way Bike Path shall be 5 feet. A minimum 2 foot wide graded area shall be provided adjacent to the pavement on each side, including a one foot area of compacted base.

Where heavy bicycle volumes are anticipated and/or significant pedestrian traffic is expected, the paved width of a two-way path should be greater than 10 feet, preferably 12 feet or more. Dual use by pedestrians and bicycles is undesirable, and the two should be separated wherever possible. Another important factor to consider in determining the appropriate width is that bicyclists will tend to ride side-by-side on Bike Paths, necessitating more width for safe use.

Clearance to Obstructions

A minimum 2 foot horizontal clearance to obstructions shall be provided adjacent to the pavement. (See Figure 2.) A 3 foot clearance is recommended. Where the paved width is wider than the minimum required, the clearance may be reduced accordingly; however, an adequate clearance is desirable regardless of the paved width, as bicyclists traveling along the edge of the pavement will be subject to potential hazards without it.

Striping and Signing

A yellow centerline stripe may be used to separate opposing directions of travel. A centerline stripe is particularly beneficial in the following circumstances: (1) where there is heavy use; (2) on curves with restricted sight distance; and, (3) where the path is unlighted and nighttime riding is expected.

Intersections with Streets

Intersections are a prime consideration in Bike Path design. If alternate locations for a Bike Path are available, the one with the most favorable intersection conditions should be selected.

When crossing an arterial street, the bicycle crossing should either occur at the pedestrian crossing, where motorists can be expected to stop, or at a location completely out of the influence of any intersection, to permit adequate opportunity for bicyclists to see oncoming vehicles. When crossing at midblock locations, rights-of-way should be assigned by devices such as yield signs, stop signs, or traffic signals (which can be activated by bicyclists). Even when crossing within or adjacent to the pedestrian crossing, stop or yield signs for bicyclists should be placed to minimize potential for conflict resulting from turning autos. Where Bike Path signs are visible to approaching auto traffic, they should be shielded to avoid confusion. In some cases, "Bike Xing" signs may be placed in advance of the crossing to alert

motorists. Ramps should be installed in the curbs, to preserve the utility of the Bike Path.

Grades

Bike Path grades and lengths that bicyclists can negotiate are dependent upon bicyclist characteristics (age, weight, conditioning, oxygen intake, etc.), bicycle characteristics (gear ratio, type of bicycle, tire weight, etc.) and the Bike Path surface. Usually the maximum grades that can be tolerated are 4% to 5%. Sustained grades should be held at 2% to 3% to accommodate a wide range of bicyclists.

Design Speed

Proper design speed for a Bike Path depends on expected use and terrain features. Minimum design speed for Bike Paths shall be 20 mph, the following design speeds are recommended.

	Design Speed (mph)
Bike Paths	20
Bike Paths on Long Downgrades (steeper than 4%, and longer than 500 feet)	30

Installation of "speed bumps" or other similar surface obstructions, intended to cause bicyclists to slow down in advance of intersections, shall not be used. Such devices can cause bicyclists to fall and can result in serious injuries. These devices cannot compensate for improper design.

Horizontal Alignment and Superelevation

Minimum recommended curve radii and superelevations for various design speeds are shown on Figure 4 and Figure 5. When minimum curve radii are selected, increased pavement width on the inside of the curve is recommended to compensate for bicyclist lean.

A straight 2 to 3 percent slope is recommended on tangent sections. Superelevations steeper than 2 to 3 percent should be avoided on Bike Paths expected to have adult tricycle traffic.

Stopping Sight Distance

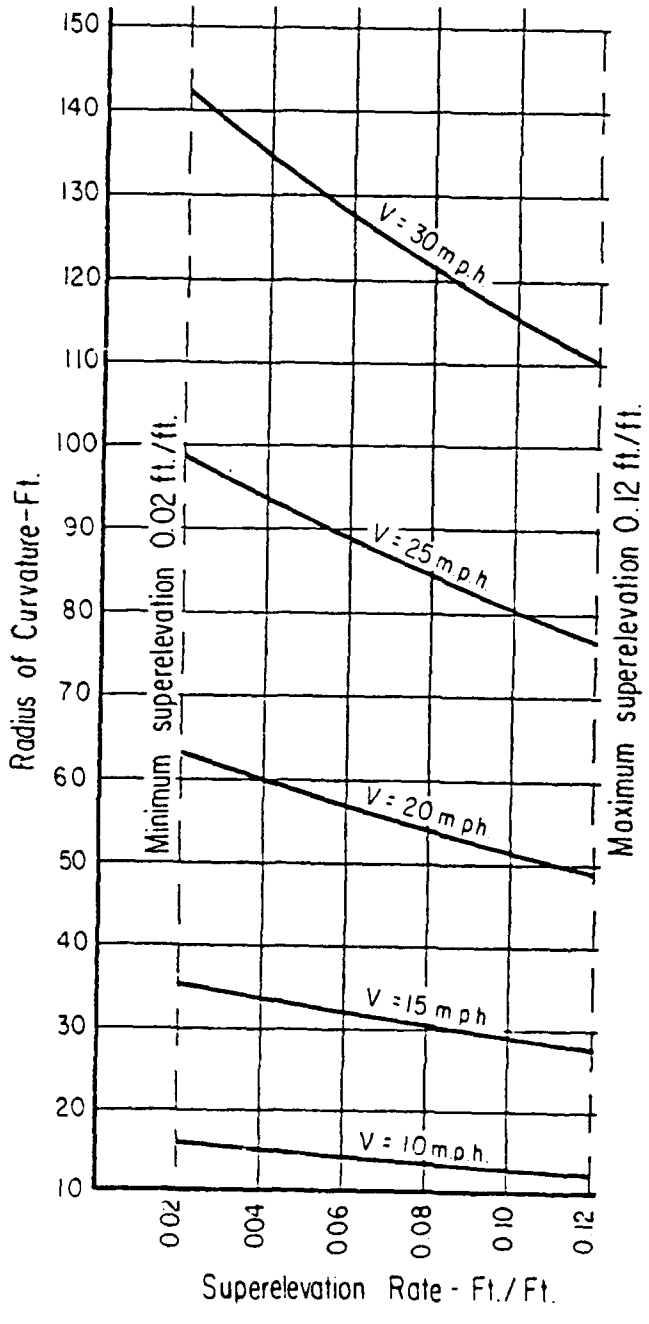
Figures 6, 7, and 8 indicate the minimum stopping sight distances for various design speeds and grades. For two-way Bike Paths, the descending direction will control the design. Stopping sight distance is the length of route ahead visible to bicyclists, including intersecting roads and driveways, available to stop or take evasive maneuvers. Passing sight distance is not considered due to low speeds of bicyclists.

Length of Crest Vertical Curves

Figure 9 indicates the minimum lengths of crest vertical curves for varying design speeds. Stopping sight distance at grade crests can be checked using the following equations:

Figure 4

CURVE RADII & SUPERELEVATIONS

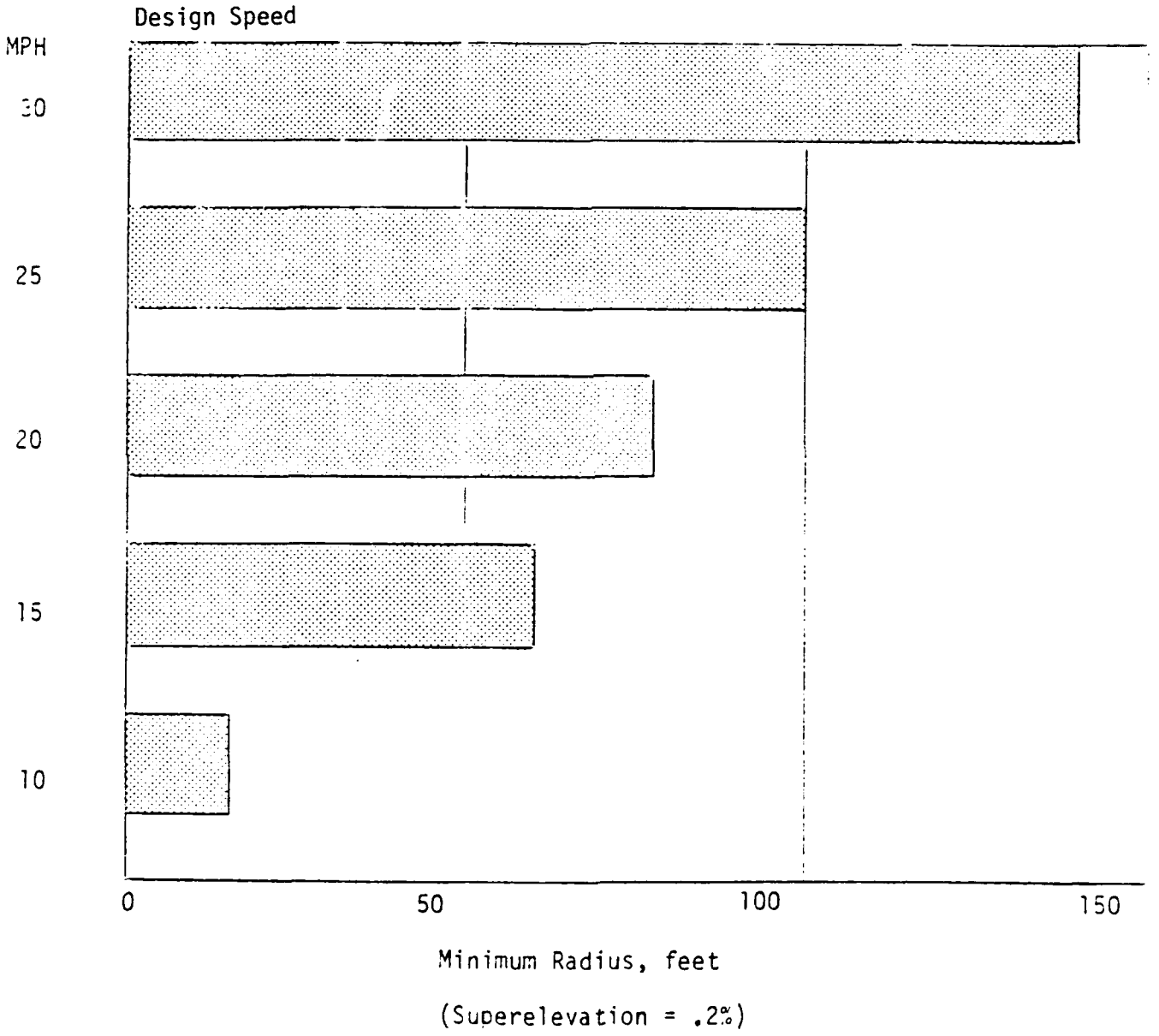


plot of: $\frac{V^2}{gR} = \frac{\tan\theta + f}{1 - f\tan\theta}$

where: V = velocity, ft./sec.
g = acceleration due to gravity, ft./sec.^{2}
R = radius of curvature, ft.
f = coefficient of friction on dry pavement = 0.4 (based on maximum 20° lean)
$\tan\theta$ = superelevation rate, ft./ft.

Figure 5

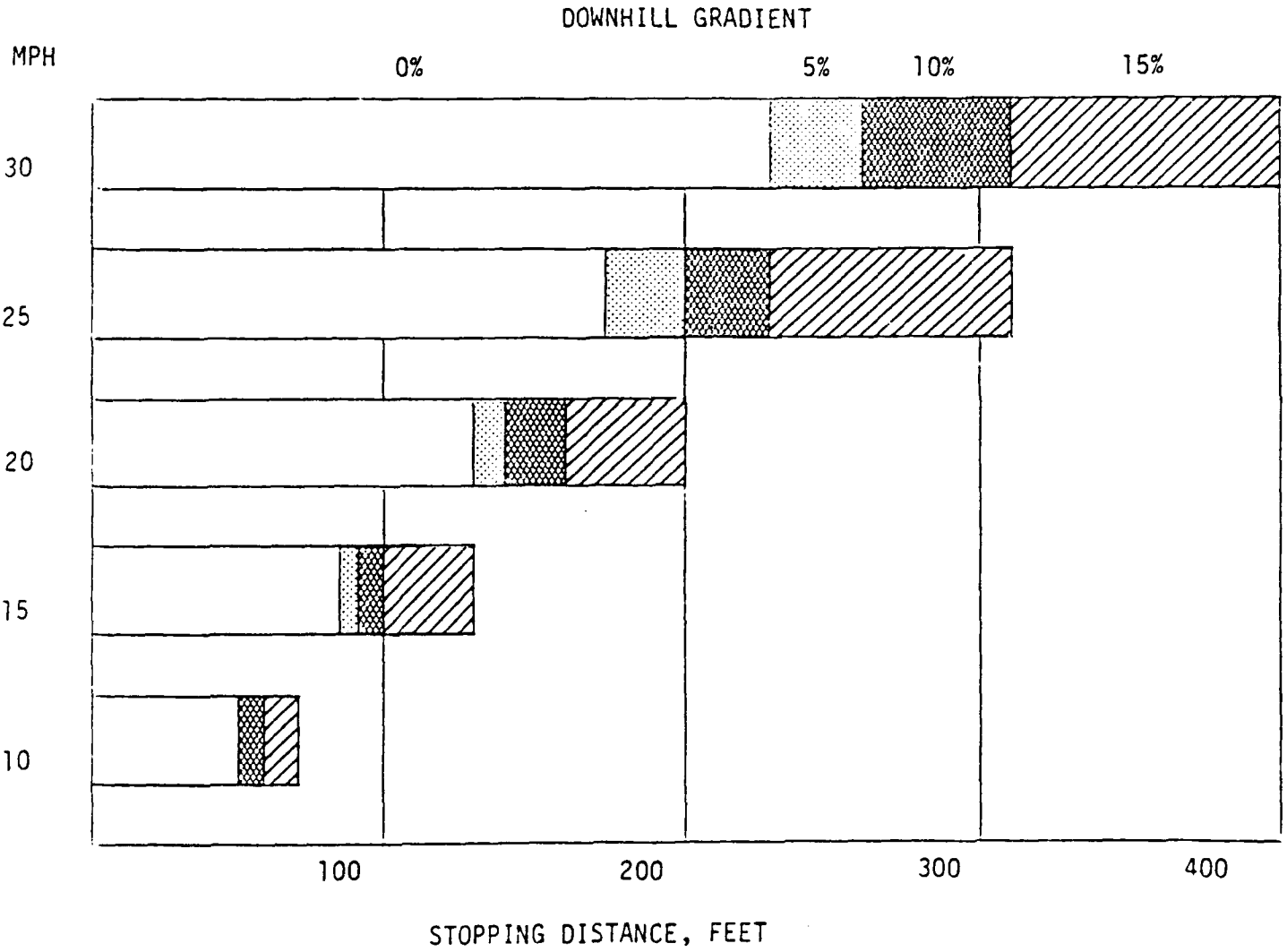
BIKEWAY CURVATURE DESIGN RADII



Note: Minimum Radius may be decreased approx. 2% per 1% increase in superelevation

Figure 6

STOPPING SIGHT DISTANCES



DESIGN STOPPING SIGHT DISTANCES FOR BICYCLES

	STOPPING DISTANCES FOR DOWNHILL GRADIENTS OF:			
DESIGN SPEED	0% FEET	5% FEET	10% FEET	15% FEET
10 MPH	50	50	60	70
15 MPH	85	90	100	130
20 MPH	130	140	160	200
25 MPH	175	200	230	300
30 MPH	230	260	310	400

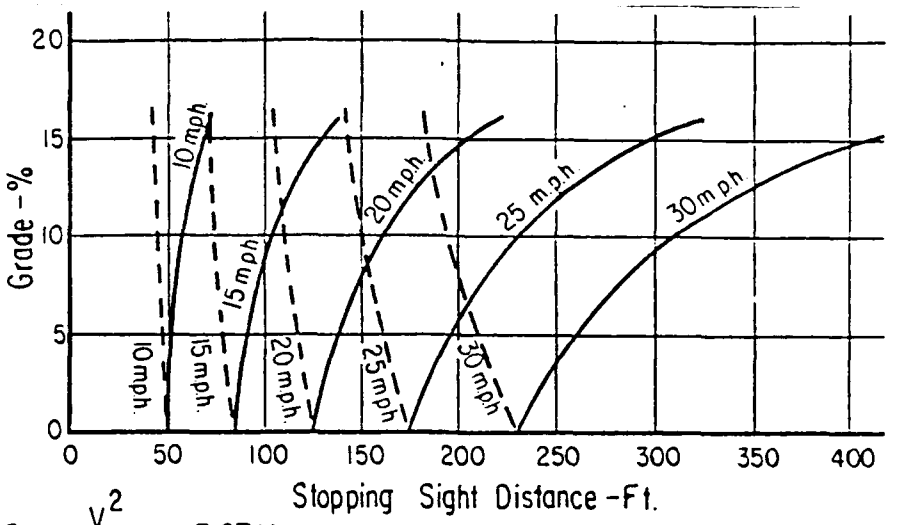
NOTE: DESIGN VALUES FOR STOPPING SIGHT DISTANCE ON BIKEWAYS CAN BE DEVELOPED IN THE SAME MANNER AS ON HIGHWAYS. THE VALUES SHOWN WERE BASED ON THE FOLLOWING FACTORS AND DEVELOPED BY AASHTO.

Coefficient of Skid Resistance 0.25
Perception-Reaction Time 2.5 seconds

Figure 7
STOPPING SIGHT DISTANCES

Figure 8

STOPPING SIGHT DISTANCES



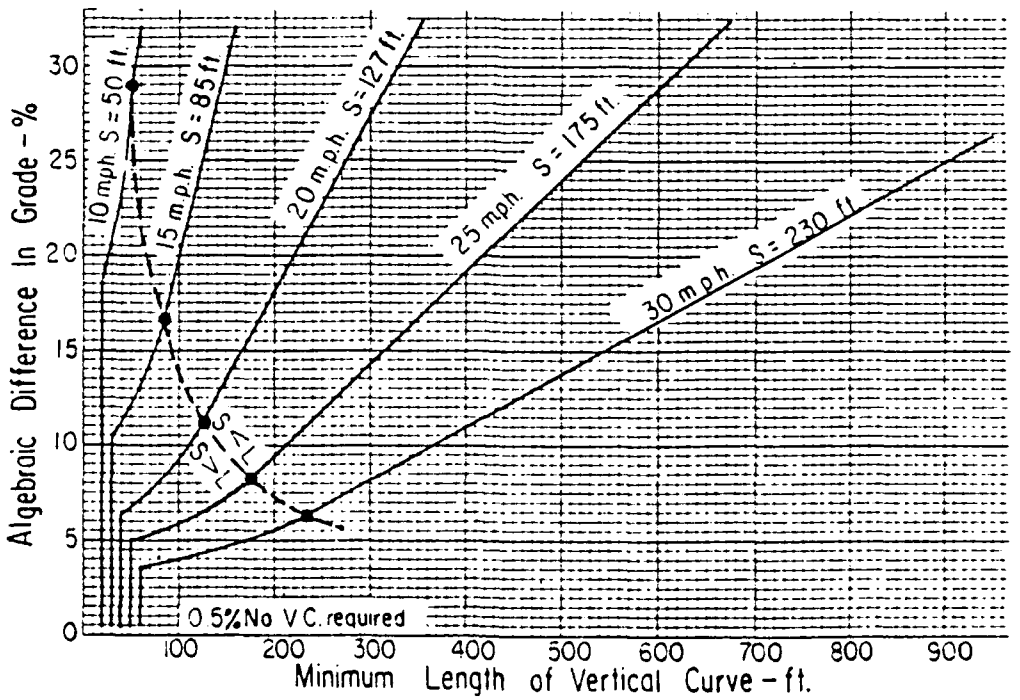
$$S = \frac{V^2}{30(f \pm G)} + 3.67\,V$$

where: S = stopping sight distance, ft.
V = velocity, mph.
f = coefficient of friction (use 0.25)
G = grade ft./ft. (rise/run)

Descend ——————
Ascend - - - - - -

Figure 9

SIGHT DISTANCES FOR
CREST VERTICAL CURVES



$$L = 2S - \frac{200\left(\sqrt{h_1} + \sqrt{h_2}\right)^2}{A} \quad \text{when } S > L$$

$$L = \frac{AS^2}{200\left(\sqrt{2h} + \sqrt{2h_2}\right)^2} \quad \text{when } S < L$$

where: S = Stopping sight distance.
A = Algebraic difference in grade.
h_1 = 4 1/2 ft. - eye height of cyclist.
h_2 = 1/3 ft. - height of object.
L = Minimum vertical curve length

When $S < L$, $L = \frac{AS^2}{1040}$

When $S > L$, $L = 25 - \frac{1040}{A}$

Where S = Sight distance in feet
L = Length of vertical curve in feet
A = Algebraic difference in grade rate in percent

2.4 Maintenance

Roadway debris is often pushed off to the shoulder area by the action of motor vehicle traffic, and presents obstacles to bicyclists. Observations have shown that many bicyclists will ride in a motor vehicle lane, rather than contend with debris in a Bike Lane.

Measures must be undertaken to ensure the surface of bikeways are maintained in a smooth condition, free of potholes and corrugations, and that gravel, broken glass, and other debris are not allowed to accumulate to the extent they might cause tire damage, loss of control, or inconvenience. Driveway aprons intersecting bikeways should be paved at least 10 feet beyond the bikeway to minimize the amount of gravel and dirt deposited on the bikeway due to crossing motor vehicle traffic.

Maintenance of bikeways includes, but is not limited to:

- Snow removal
- Removal of sand used on streets in winter
- Trimming trees and shrubbery to maintain sight distances
- Minor repairs to surfaces
- Hazard corrections
- Maintaining proper signs and surface markings

Most of the proper equipment needed to provide a good maintenance program is already present within the City's inventory. Establishing a regular inspection and maintenance program will go a long way towards encouraging system usage.

3.0 Existing Conditions

3.1 Cheyenne Area Bikeway System

Portions of the existing bikeway system were constructed in 1978 and have served the public for six years. As one means of evaluating the effectiveness of the system, accident data was obtained from the Wyoming Highway Department, Urban Accident Section. This data reflects bicycle/motor vehicle accidents in Cheyenne between 1980 and 1983.

During this time period, nine accidents occurred on bikeway facilities and 34 were recorded on non-designated streets. It should be noted that there is no way of determining the percentage of total ridership the bikeway facilities serve. Based on the observed tendencies of most riders to use the more direct routes, those bikeway facilities on Collectors and Arterials are probably used fairly heavily. The low ratio

of accidents on designated vs. non-designated bikeways (9 vs. 34) is cause for cautious optimism. Motorists and bicyclists are apparently aware of the bikeway facility as evidenced by the lower accident rates. An education program for bicyclists is necessary to convey the effectiveness of the available system.

The only portion of the bikeway system that is particularly susceptible to accidents is Highway 219 between Montclair Drive and Prairie Avenue. Four accidents occurred within that half mile stretch of roadway. This is an area where high speed traffic and bicyclists mix - usually a dangerous situation. More signing and markings should be installed to make bicycle usage more visible, or the Bike Lane could be relocated to neighborhood streets such as Education Drive or Sunset Drive.

3.2 Project Area Characteristics

A physical inventory of the South Cheyenne area was performed in late 1984. This work included a study of land uses and available roadway facilities throughout South Cheyenne, in conjunction with a bike census and photo log. The study area was divided into six neighborhoods defined by the major transportation corridors in the area. These corridors are the Union Pacific Railroad, South Greeley Highway, Interstate 80 and College Drive. The bicyclist/pedestrian can travel within each of these neighborhoods relatively easily, but can safely cross these major corridors only at certain access locations. The following text addresses each of these neighborhoods separately to consider their individual generators/ attractors, travel characteristics and problems related to bikeway planning.

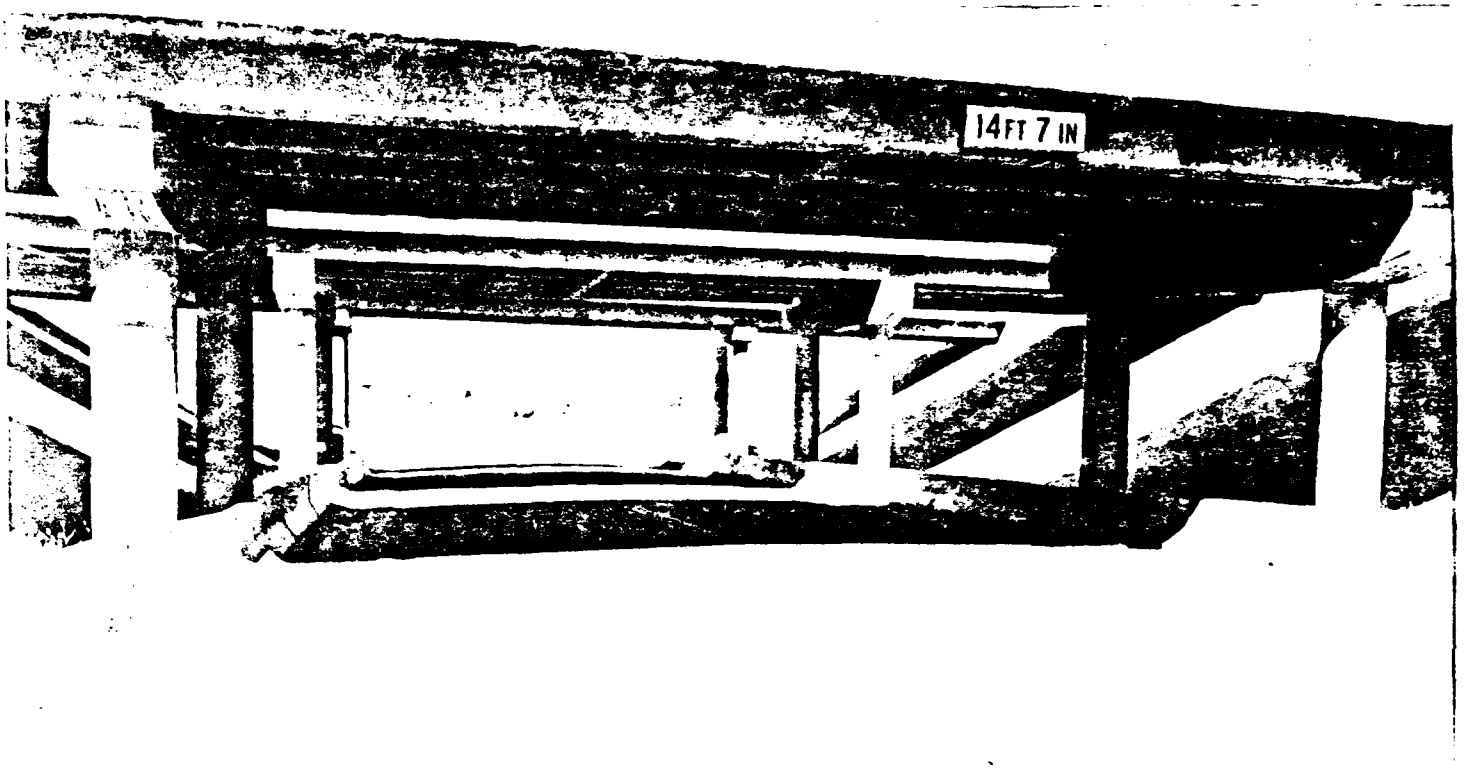
- Neighborhood 1 (Between Union Pacific Railroad and Interstate 80, between Parsley Boulevard and South Greeley Highway)

  This neighborhood is characterized by relatively mature subdivisions (portions of the original City) and a good paved roadway network. There are approximately 310 residential units, a commercial strip along the Highway and industrial development west of Parsley Boulevard. Deming Drive and Ninth Street are classified as Minor Arterials and Walterscheid Boulevard and Fifth Street are Collectors that serve the neighborhood. Based on observed use, Fifth Street, rather than Ninth Street, serves as a minor arterial. An existing Bike Lane/Bike Route system is located on Fifth and Seventh Streets and Cribbon Avenue. This system serves Cole Elementary School and benefits from two overpass structures - to the east at the Highway and Seventh Street and to the south at Interstate 80 and Cribbon Avenue.

  Photos 1 and 2 show the problems that confront the bicyclist along the south perimeter of Neighborhood 1.

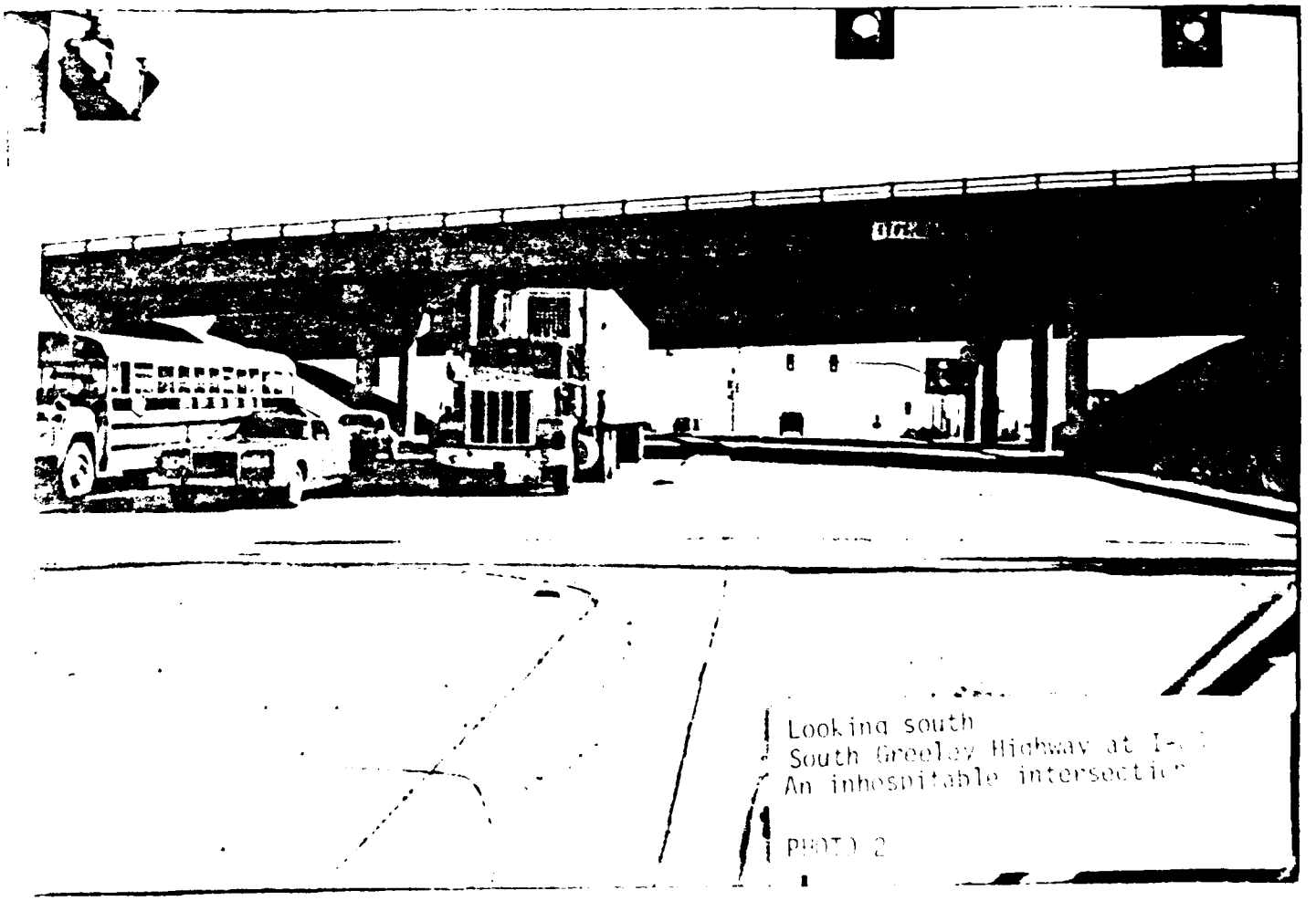
- Neighborhood 2 (between Union Pacific Railroad and Interstate 80, between South Greeley Highway and North College Drive)

  Neighborhood 2 has mature subdivisions and good roadways similar to neighborhood 1. The approximately 690 residential units are located in a relatively compact grouping to the west side of the neighborhood. The east side of the neighborhood has extensive industrial



Looking north on Walterscheid
@ I-80 underpass

PHOTO 1



Looking south
South Greeley Highway at I-
An inhospitable intersection

PHOTO 2

developments with the Port of Cheyenne and the Husky Refinery. Fifth Street is a Minor Arterial, and First and Ninth Streets, Morrie Avenue and Camp Stool Road are Collectors. There is an existing Bike Lane system along Seventh Street which uses the viaduct overpass to cross the South Greeley Highway. The primary attractor in the neighborhood is Hebard Elementary School.

Photos 3 and 4 depict the only existing I-80 crossings available to the southbound bicyclist.

- Neighborhood 3 (between Interstate 80 and College Drive, between Parsley Boulevard and South Greeley Highway)

  This neighborhood and neighborhood 4 will probably grow quickly in the near future. Neighborhood 3 has approximately 1140 single family residential units - the bulk of these (810) are clustered along I-80 and Parsley Road in the Arp Addition and Rancho Estates. One of the primary reasons for the rapid projected growth here is the presence of educational, commercial and industrial facilities. Rossman and Goins Elementary Schools and Johnson Junior High are bicycle/pedestrian attractors. The east side of the neighborhood features commercial development with the Town and Country Shopping Center. The west side has clean industrial development with the Unicover and AMF/Wyott facilities. Collector streets are: Leischer Road/Fox Farm Road, Allison Road, Cribbon Avenue, Snyder Avenue and Walterscheid Avenue.

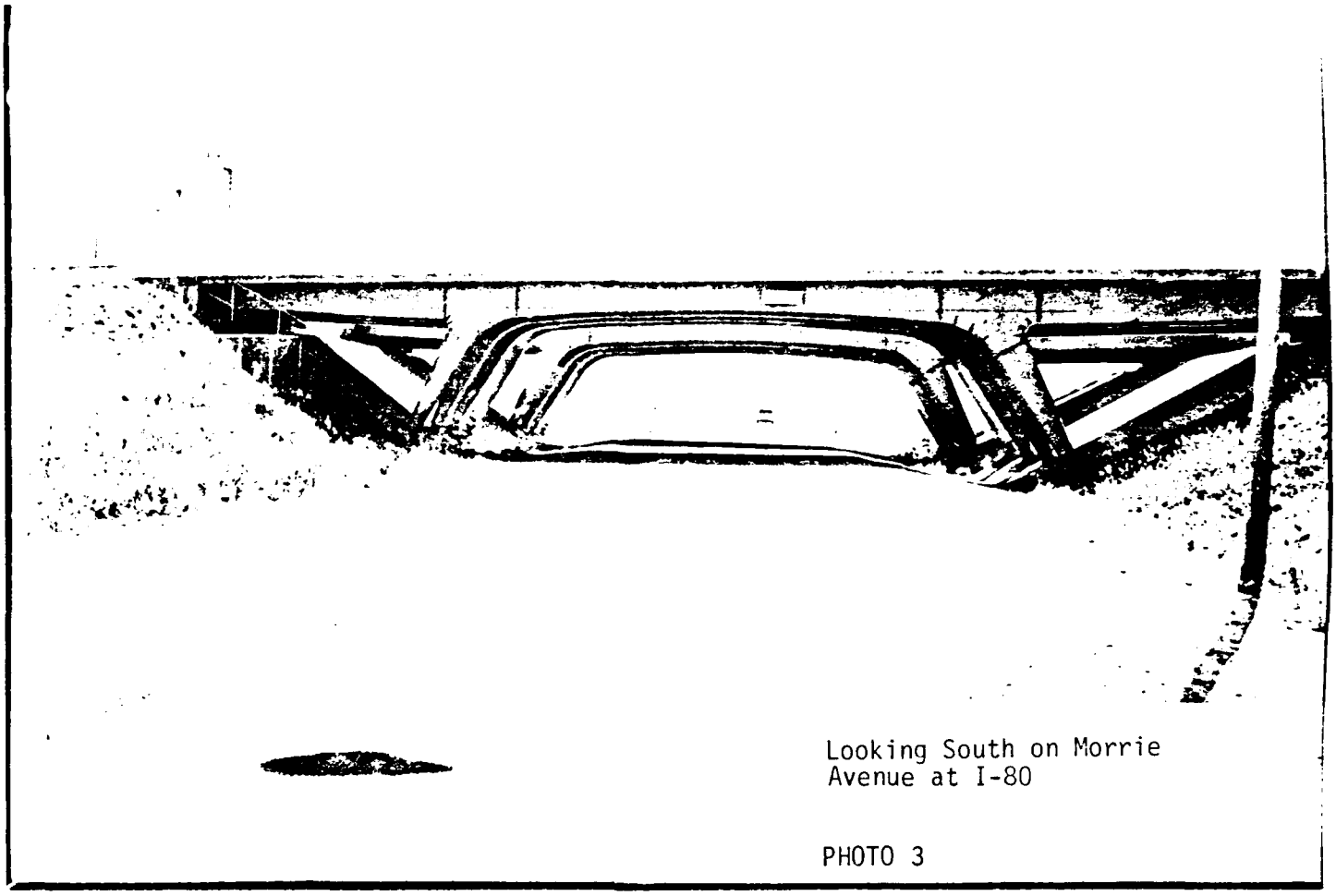
  Currently, the South Cheyenne area is being studied for development of a park and recreation facility. The site chosen through preliminary investigation is a parcel located northeast of the Parsley Boulevard and College Drive intersection, south of the Johnson Junior High School. If developed, this recreational facility will probably accelerate neighborhood growth.

- Neighborhood 4 (between Interstate 80 and College Drive, between South Greeley Highway and North College Drive)

  Neighborhood 4 should experience a relatively high growth rate in the near future. There are approximately 850 residential units situated in this area - mostly between the South Greeley Highway and Avenue C. The existing development is somewhat scattered with a mixture of traditional single family dwellings and small mobile home parks. The Arp Elementary School receives heavy bike traffic and the Laramie County Community College could be a prime attractor as this neighborhood becomes built up. The strip commercial development along the South Greeley Highway also will attract bicycle/pedestrian traffic throughout the neighborhood. Photos 5 and 6 show the existing conditions along the Highway. Interior roadways are Fox Farm Road and Avenue C which are both Collectors.

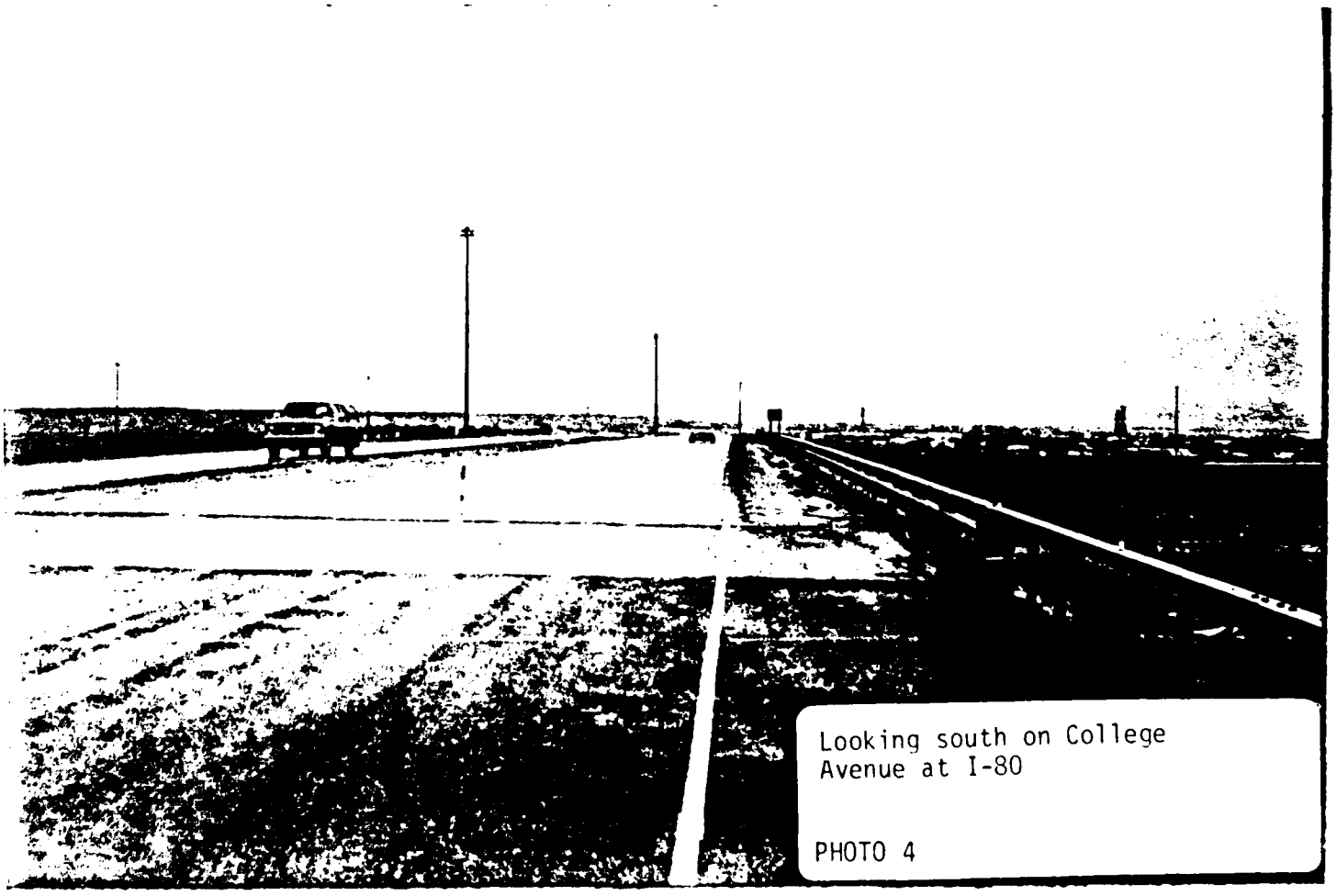
- Neighborhood 5 (south of College Drive and west of the South Greeley Highway)

  This neighborhood contains several large mobile home parks along the highway and single family residential units along College Drive.



Looking South on Morrie Avenue at I-80

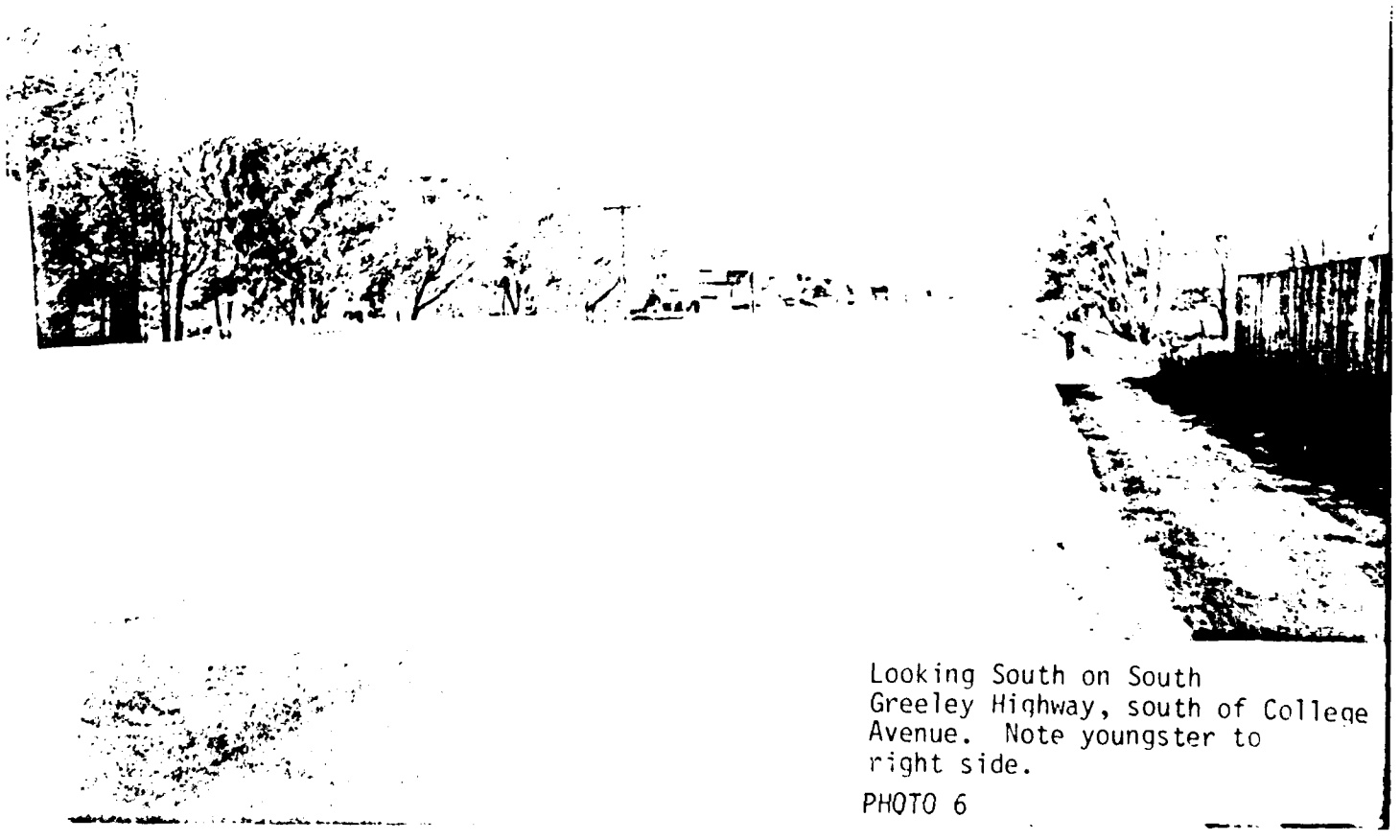
PHOTO 3



Looking south on College Avenue at I-80

PHOTO 4

Looking South
South Greeley highway at
at Town & Country Shopping
Center
PHOTO 5



Looking South on South
Greeley Highway, south of College
Avenue. Note youngster to
right side.
PHOTO 6

There are no major attractors within the neighborhood, although the mobile home parks would potentially generate large numbers of users for any bikeway/pedestrian corridor. At present, many of the children living in the neighborhood are being bused because there are not safe alternatives available via bike or foot. There are few paved roadways within the neighborhood and no major streets. A future extension of Walterscheid Boulevard is planned, which should include much needed bikeway/pedestrian facilities into the neighborhood.

- Neighborhood 6 (south of College Drive and east of the South Greeley Highway)

  This neighborhood is dominated by the salvage/scrap metal businesses along the highway. There are approximately 100 residential units with 50 located at the southwest corner of Avenue C and College Drive. There are no attractors and no major roadways, either existing or planned, within the neighborhood.

  This neighborhood would be adequately served by the short term development of College Drive and the future development of a service corridor along the highway.

The previous commentary does not consider the new senior high school planned for the South Cheyenne area, south of Interstate 80 and north of College Drive. The location study has not yet been completed but siting will strongly affect growth patterns and bikeway requirements.

4.0 Bikeway Improvement Plan

4.1 Needs Assessment and Concepts Plan

The needs assessment of each of the South Cheyenne neighborhoods has been addressed in Section 3. Full size plans including Cover Sheet (1), Existing Land Uses (2), Proposed Bikeway System (3) and Signing and Marking Details (4) were prepared; copies of these are available from the Cheyenne Area Transportation Planning Office. Reduced copies of Sheets 2 and 3 are included in the back of the report for reference in reviewing the following bikeway improvement recommendations for individual neighborhoods.

Neighborhood 1

Recommended short term improvements are to develop a connection to the west central part of town and an additional access to the south. The connection to the west central part of town will be a Bike Lane established on Deming Drive that uses the Union Pacific underpass. This lane would connect to an existing Bike Route to the north located on Twenty-Second Street. The connection to the south will use the Fox Farm/I-80 underpass to reach neighborhood 3. This link is important since it allows access to recreational opportunities and the developing commercial uses along the South Greeley Highway. Long term improvements will include connection of the system to the Upland Park (west of Parsley Boulevard) as it is developed. The Parsley Boulevard corridor may eventually require development, but no improvement needs are identified now.

Neighborhood 2

Recommended short term improvement is to develop a Bike Lane along Morrie Avenue connecting to neighborhood 4 to the south. This Bike Lane could develop recreational opportunities and connect with Laramie County Community College. Long term provision for a Bike Lane along the North College Avenue Corridor will not directly benefit this neighborhood. Rather, it is necessary to improve connections between east Cheyenne and the community college. The Camp Stool Road corridor could develop as a recreational use with help from the neighborhood industries. This would allow residents to use a potentially attractive area along the Union Pacific tracks to the east.

Neighborhood 3

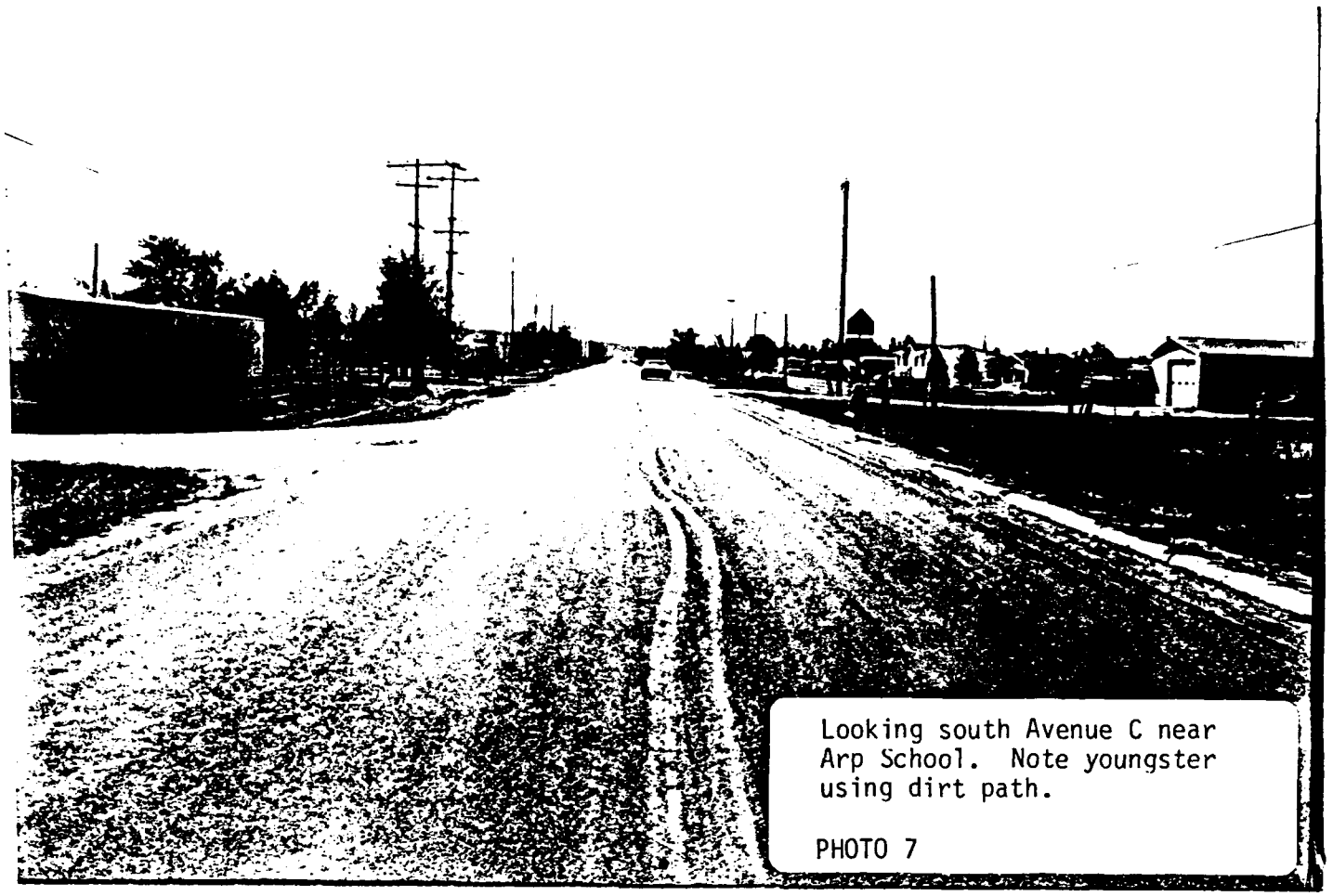
The most pressing short term improvements are the development of the Leischer Road/Fox Farm Road and Walterscheid Boulevard corridors for bicyclists/pedestrians. Leischer Road/Fox Farm Road between Cribbon Avenue and Walterscheid Boulevard can be adequately developed through striping existing pavement to create Bike Lanes. Fox Farm Road between Walterscheid Boulevard and the South Greeley Highway is marginally acceptable for Bike Lanes. A preferred improvement would be construction of a Bike Path adjacent to the roadway or south of the road within the Western Area Power Association easement (refer to Section 4.2). Walterscheid Boulevard between Fox Farm Road and College Avenue is 24' wide. Construction will be necessary to either widen the shoulders for Bike Lanes or provide a detached Bike Path.These corridors will serve the schools and allow access from the Arp Addition and Rancho Estates to the South Greeley highway commercial strip.

Long term development should focus on providing some type of local bikeway near Parsley Road and College Drive. This could be accomplished with the cooperation of the developers in conjunction with construction of the park-recreation area.

Neighborhood 4

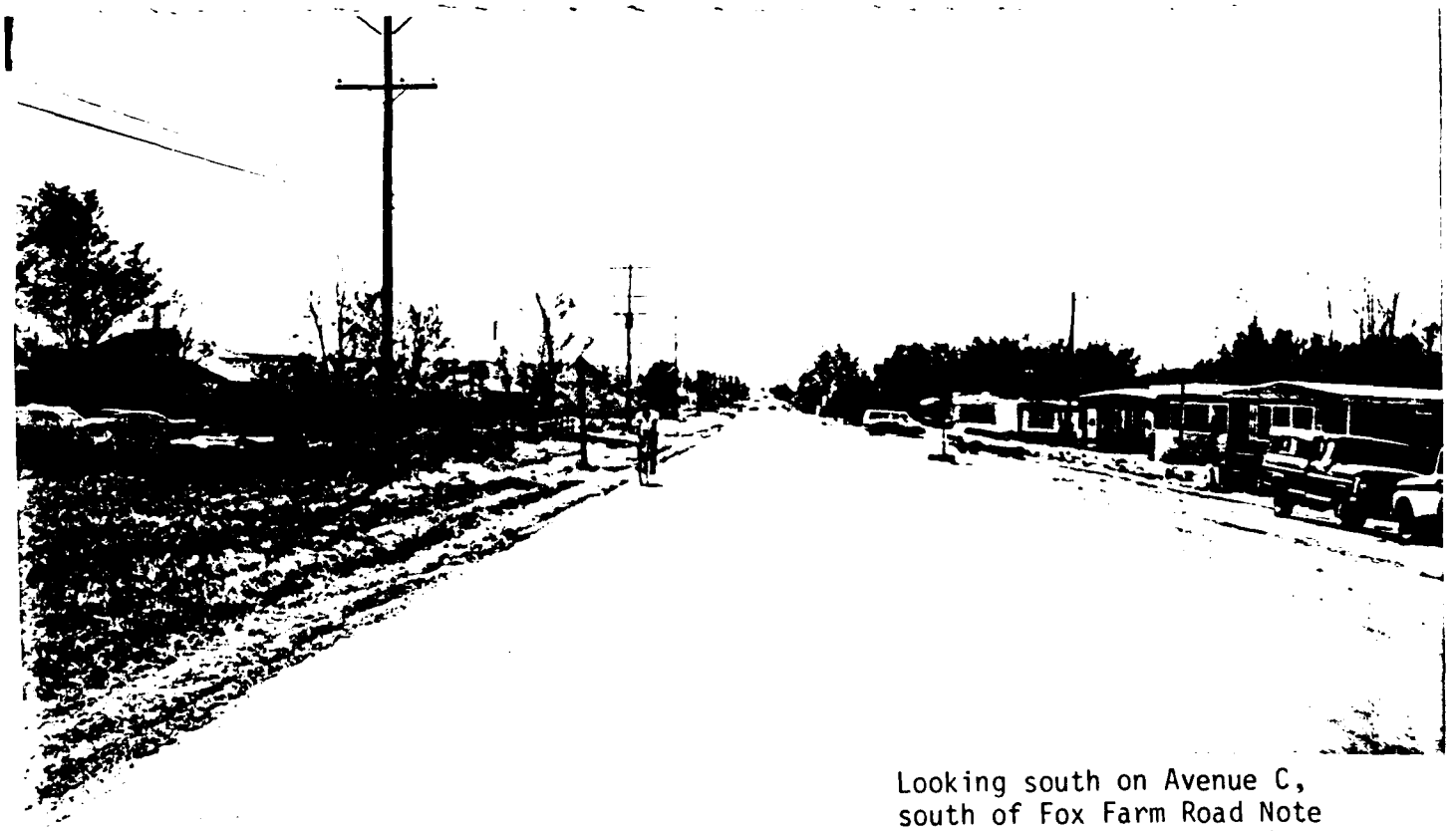
Neighborhood 4 contains the single most urgent project within the study area.

The development of the one mile segment of Avenue C between Fox Farm Road and College Drive should be given the highest priority. Avenue C is a 24' wide paved roadway with curb and gutter on the west side of the pavement. The moderate volume of vehicular traffic coupled with the heavy bicycle/pedestrian traffic to the elementary school has created a dangerous situation. At present the children are either competing with traffic or using a dirt pathway along the west side of the road (note Photos 7 and 8). A separate Bike Path should be built to replace this dirt path. Long term improvements should include signing and striping College Drive and North College Drive to allow for easier and safer access to the community college.



Looking south Avenue C near Arp School. Note youngster using dirt path.

PHOTO 7



Looking south on Avenue C, south of Fox Farm Road Note bike rider in foreground.

PHOTO 8

Neighborhood 5

The development of a service plan for the South Greeley Highway and incorporation of bicycle/pedestrian facilities for the southern extension of Walterscheid Boulevard will adequately serve this neighborhood.

One of the higher priority needs in the South Cheyenne area is development of a bikeway system along the South Greeley Highway strip. The commercial strip along the Highway serves as a primary attractor for bike traffic throughout South Cheyenne. However, the presence of multiple service entrances coupled with heavy traffic volumes makes the area a hostile environment for bicyclists. The Wyoming Highway Department does not want to designate a heavily traveled roadway such as the South Greeley Highway as a bike corridor. The Highway Department feels that the designation would encourage additional usage by riders. However, since the commercial strip is such a large attractor, some service should be provided to bicyclists.

Long term plans should include bikeway improvements as part of roadway upgrading. One option would be to develop a separate, detached Bike Path behind the curb line. A second option would be to mark Bike Lanes in widened roadway shoulders. A bicycle/pedestrian link could also be developed west to Walterscheid, preferably via Allison Road.

Neighborhood 6

This neighborhood has been adequately addressed in Section 3.

4.2 Alternatives Evaluated

The service corridors shown should function as a general guideline to the designers that implement this plan. Many portions of this plan allow for flexible solutions in development of the preliminary and final designs. Some factors to consider in future plans are noted below.

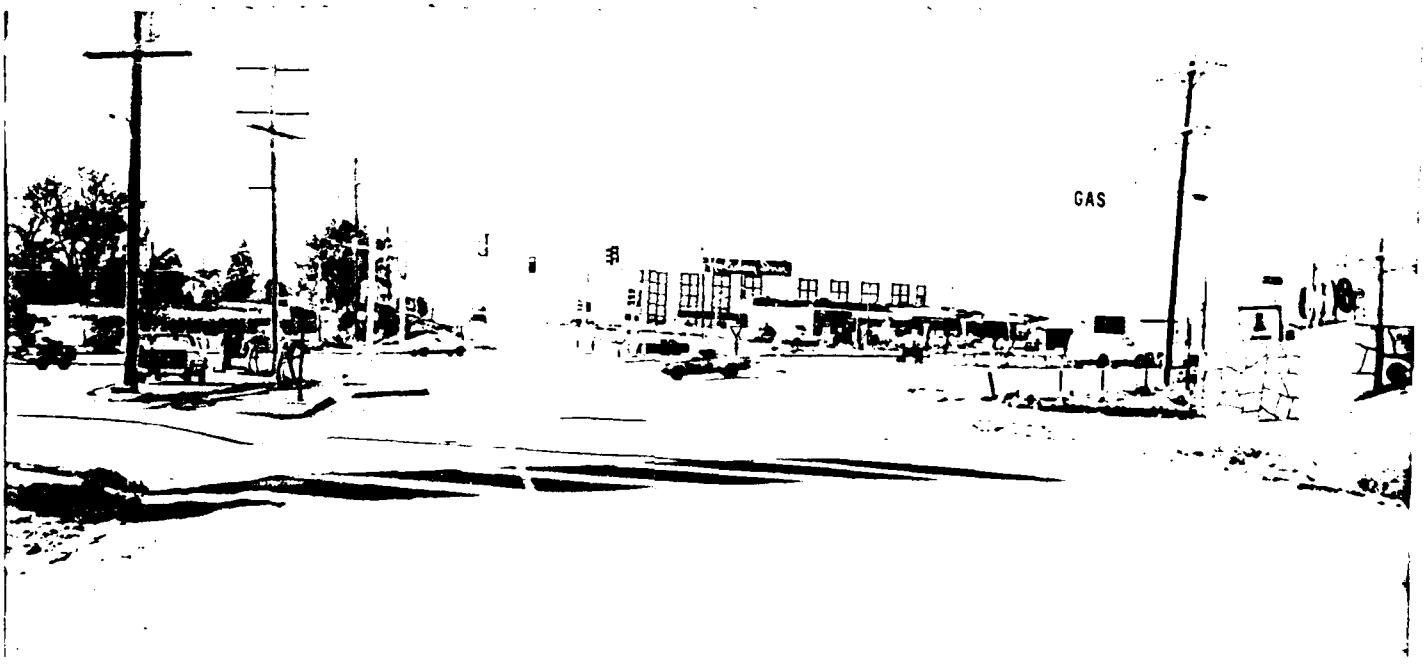
Parsley Boulevard and College Drive - The land located northeast of this intersection is prime for development considering the proximity to schools and the Cheyenne Progress Center (AFM/Wyott and Unicover). As this land develops, the City can provide for a Bike Path or Bike Lane to connect with College Drive.

Allison Road - Currently, this road is classified as a Collector between Cribbon Avenue and Walterscheid Boulevard. The recent improvements on the roadway appear to be heavily used by the Junior High traffic. Therefore, it would be a logical continuation to upgrade Allison Road to Collector status between Walterscheid and the South Greeley Highway. This would also provide a needed additional access to the South Greeley Highway industrial strip.

Fox Farm Road - The portion of Fox Farm Road between Walterscheid Boulevard and the South Greeley Highway is particularly treacherous (refer to Photos 9 and 10). Due to the heavy vehicular traffic, it would be difficult to improve bicycle facilities without a significant roadway improvement project. An alternative would be utilizing the existing Western Area Power Association easement to develop a Bike Path between

Looking East on Fox Farm Road
at South Greeley Highway

PHOTO 9

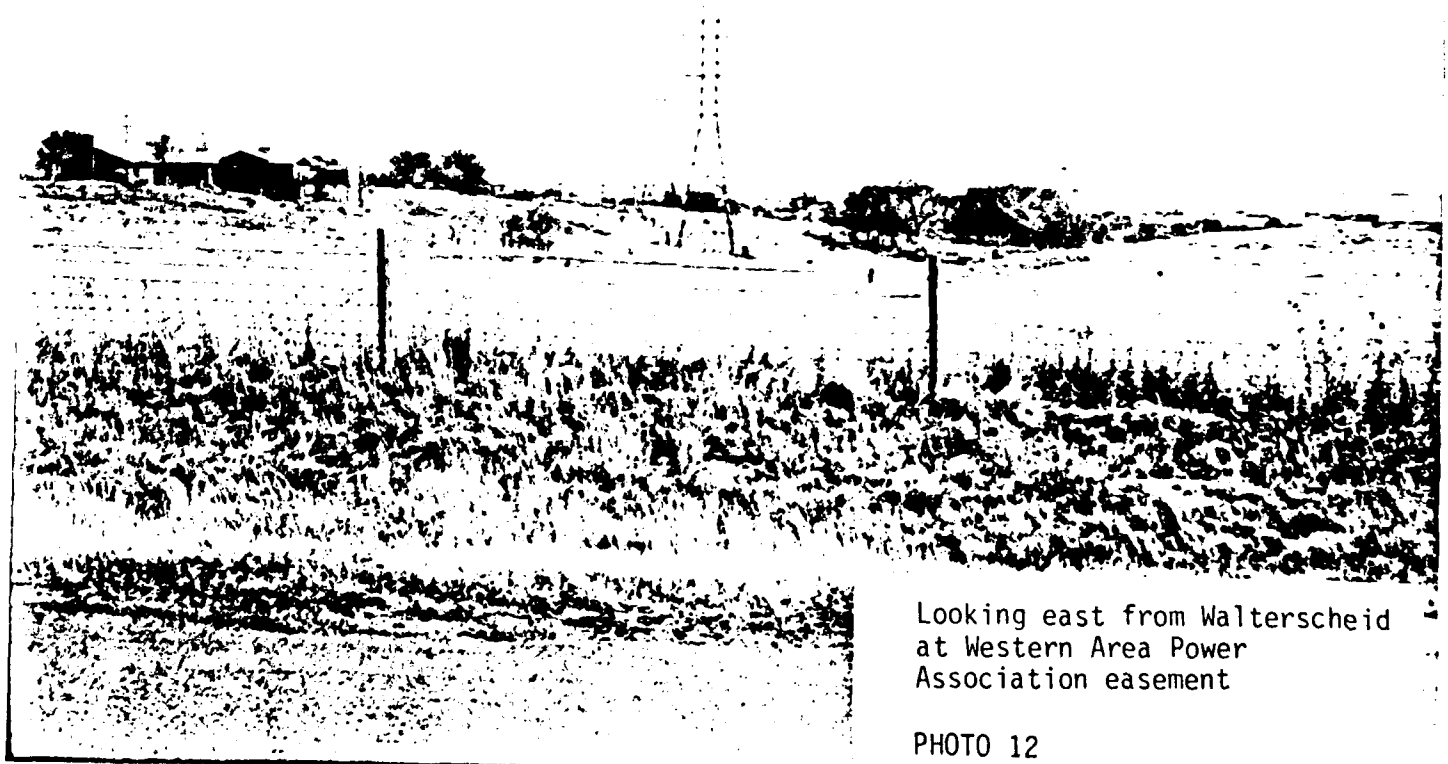


Looking West on Fox Farm Road
at S. Greeley highway inter-
section

PHOTO 10

Looking east from South Greeley Highway at Western Area Power Association easement.

PHOTO 11



Looking east from Walterscheid at Western Area Power Association easement

PHOTO 12

Walterscheid Boulevard and Avenue C (refer to Photos 11 and 12). Based on preliminary contacts, WAPA appears receptive to this use within their easement. A concern would be the South Greeley Highway crossing -it would probably require construction of some type of overpass structure similar to that existing at Seventh Avenue or installation of an actuated pedestrian/bicycle crossing protected by traffic signals. A Bike Path along this route would offer additional benefits as a recreational corridor.

5.0 Implementation Program

5.1 Priority Staging

The Proposed Bikeway System shown on Sheet 3 identifies a short term and long term network. The time frame of the long term system is tied to the growth of the area. However, the short term improvements could be initiated immediately.

The most critical short term improvement is the provision of a Bike Path on Avenue C between Fox Farm Road and College Avenue. Although this project was discussed previously it bears repeating at this time. The Avenue C corridor represents the only viable alternative for pedestrians and bicyclists to reach Arp School. Elementary school children are daily competing with vehicular traffic while negotiating this roadway. A separate Bike Path on the west side of the existing road is badly needed.

The next priority locations for development are the Fox Farm Road and Walterscheid Boulevard corridors. Again, these are corridors that school children will use with increasing frequency.

The remainder of the short term improvements (College Drive and Allison Road) can be addressed as the budget permits.

5.2 Cost Estimates

Bikeway costs are particularly sensitive to the size of the project bid. The City is encouraged to package several miles worth of improvements to develop a competitive bidding situation. Including bikeway construction within roadway improvement projects is another method of reducing facility costs.

Bituminous Bikepath, 10' wide with 2" Asphalt Concrete and 4" Base Course. Includes subgrade preparation.	$16.50/L.F. $87,000/mile
Concrete Bikepath, 10' wide with 4" thick concrete. Includes minimal subgrade preparation.	$19.25/L.F. $101,600/mile
Signs 18" x 24", reflectorized with mounted post. Signs will require replacement of 10% of installations per year.	$55/ea.

Painting lines on pavement, reflectorized white or yellow, 4" wide.	$0.10/L.F. $530/mile
Thermoplastic, 4" wide.	$0.34/L.F. $1795/mile
Bike rack, 10' long - permanent.	$275/ea.
Precast concrete pedestrian bridge, 100' span. Complete in place, excluding foundations.	$36/S.F. deck

Source: Means - Site Work Cost Data - 1984.

5.3 Funding Sources

There are several funding alternatives available to assist in developing bicycle/pedestrian facilities in South Cheyenne. The County Road and Bridge Department is funded through the County's budgetary process. This Department's responsibility could possibly encompass underpass improvements (i.e. Walterscheid Boulevard at I-80) and new bikeway/pedestrian overpass construction (i.e. across South Greeley Highway south of Fox Farm Road).

Most of the roadways that function as Collectors or Arterials in South Cheyenne are part of the County or State network. Walterscheid Boulevard and Avenue C are within the Laramie County roadway system while Fox Farm Road, College Drive and South Greeley Highway are included in the State of Wyoming system. These roadways form the backbone of the future bikeway/pedestrian network in South Cheyenne. The State County - County Farm-to-Market (SC-CFM) funds are administered through the Wyoming Highway Department and generally involve major projects and capital improvements. SC-CFM funds that are used to upgrade the roadway network can conversely improve the bikeway system with a minimal additional expense.

The Peacekeeper program also provides funding to alleviate development impact within the community. With the anticipated growth in South Cheyenne, monies will be available for bicycle and pedestrian facilities.

5.4 Joint Development Options

There are two important considerations which Cheyenne area transportation planners and engineers should address in overall transportation project scheduling and budgeting. First, on publicly funded projects (street and highway improvements) consideration should be given to wider than standard pavement sections so that bikeways can be provided with the street. The incremental cost of this approach is small in comparison to the cost of bikeway improvements when done as separate projects, but the benefits are comparable.

Second, on private development projects (residential, commercial, institutional), the development review process should consider provision of bikeway facilities. As a practical matter, development review usually involves negotiations and trade-offs between the developer and public

works agencies. Such items as utilities, street design, landscaping, storm drainage, easements, park areas, and the like are refined and agreed to in these negotiations. Bikeway facilities should be added to the checklist of development review topics, and considered in rezoning, plan approval and platting reviews.

APPENDIX A - PROJECT CONTACTS

Cheyenne Area Transportation Planning Resources Ralph Cipriani, Transportation Planner	637-6299
City of Cheyenne Brent Williams, Traffic Engineer	637-6200
Laramie County Bob Whitney, County Engineer (ret.)	638-4303
Wyoming Highway Department Pat Persson, District Traffic Engineer	742-6695
FHwA/School District Al Atkins, Engineering Coordinator & Safety Engineer	772-2101
Cheyenne School District #1 Jim Brady, Facilities Planner	638-0591
Architects/Noel Griffith & Associates Noel Griffith	632-2705
Western Area Power Association Dave Griffith	(319) 224-7900
Planners/EDAW Tom Keith	484-6073

APPENDIX B - REFERENCES

1. Harrisburg Area Pilot Bikeway Plan, conducted by Barton-Aschman Associates, Inc. for the Pennsylvania Department of Transportation, 1976.

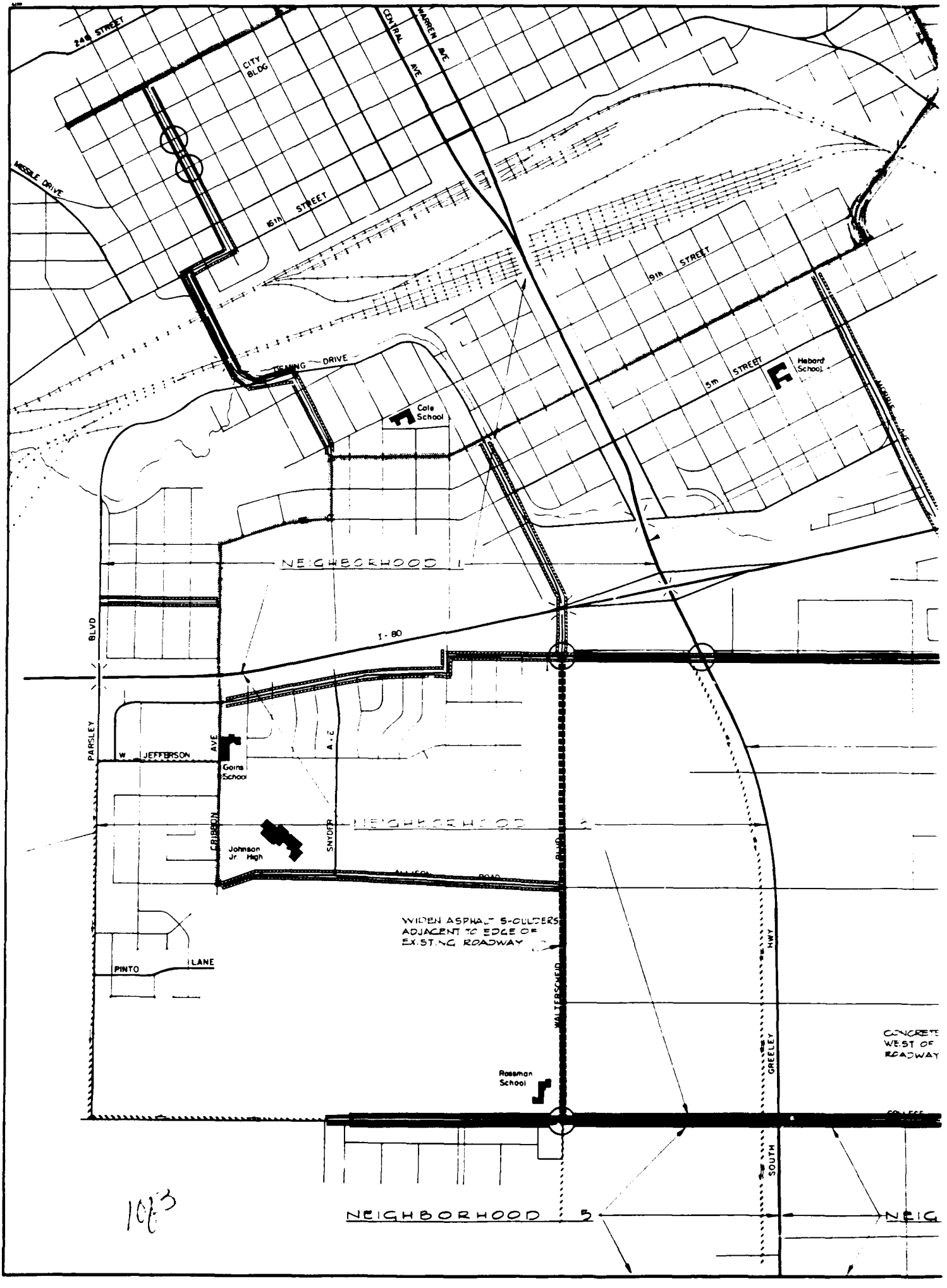
2. Guidelines for Urban Major Street Design, ITE Technical Council Committee, 1980.

3. Planning and Design Criteria for Bikeways in California, State of California Business and Transportation Agency, Department of Transportation, 1978.

4. Greeley Comprehensive Bicycle Plan, Community Development Department, City of Greeley, CO, 1979.

5. California Highway Design Manual - Bikeway Planning and Design, California Department of Transportation, 1983.

6. Two Wheeling in Cheyenne, Cheyenne-Laramie County Regional Planning Office, 1975.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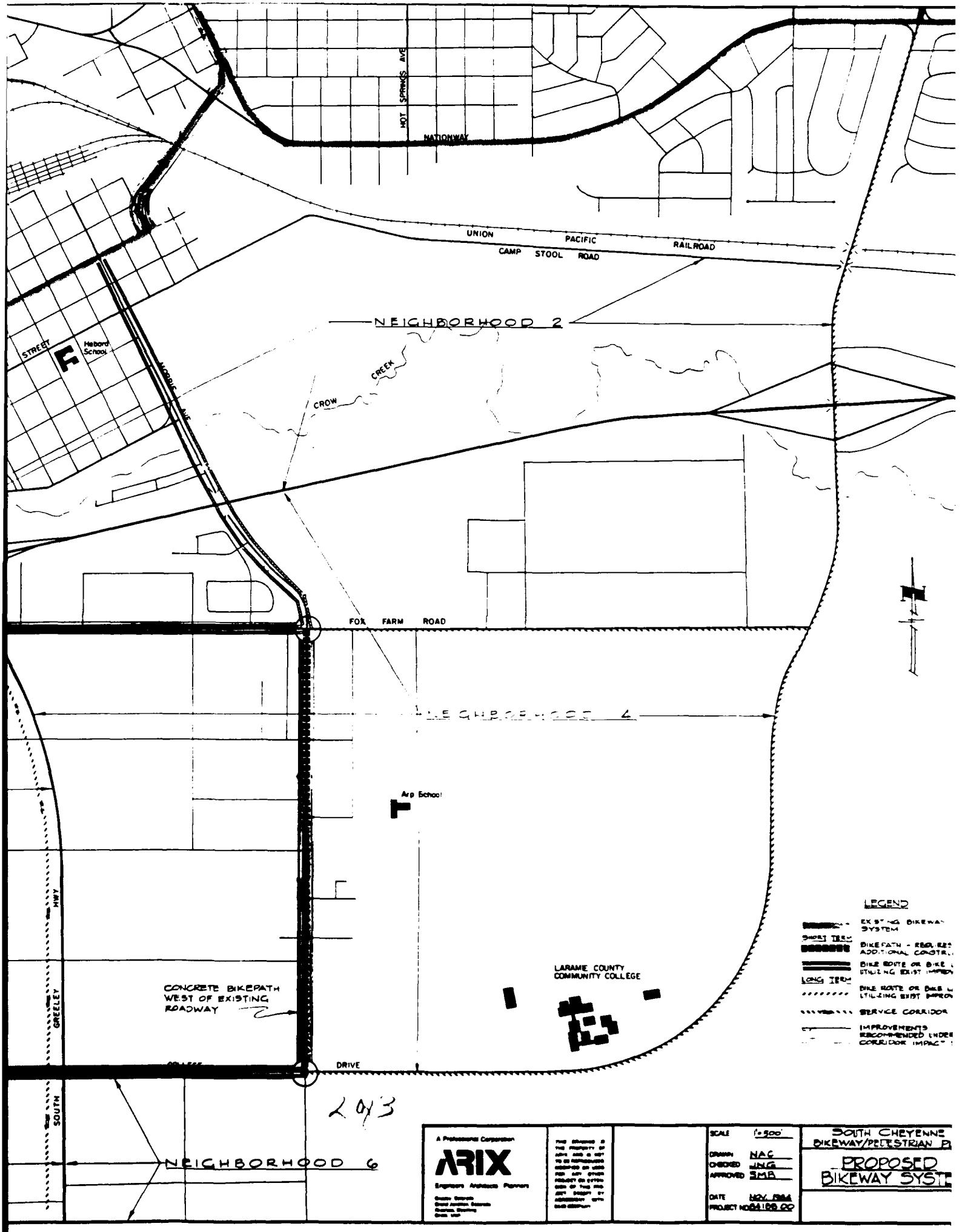
CITY BLDG
CENTRAL AVE
WARREN AVE
MISSILE DRIVE
15th STREET
9th STREET
5th STREET
DEMING DRIVE
Cole School
Hebard School
NEIGHBORHOOD 1
I-80
PARSLEY BLVD
W. JEFFERSON AVE
Goins School
CRIBBON
SNYDER
A.E.
Johnson Jr. High
NEIGHBORHOOD 2
ALLISON ROAD
BLVD
WIDEN ASPHALT SHOULDERS ADJACENT TO EDGE OF EXISTING ROADWAY
PINTO LANE
WALTERSCHEID
GREELEY HWY
CONCRETE WEST OF ROADWAY
Rossman School
SOUTH
NEIGHBORHOOD 3
NEIG
103



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ARIX
Engineers Architects Planners

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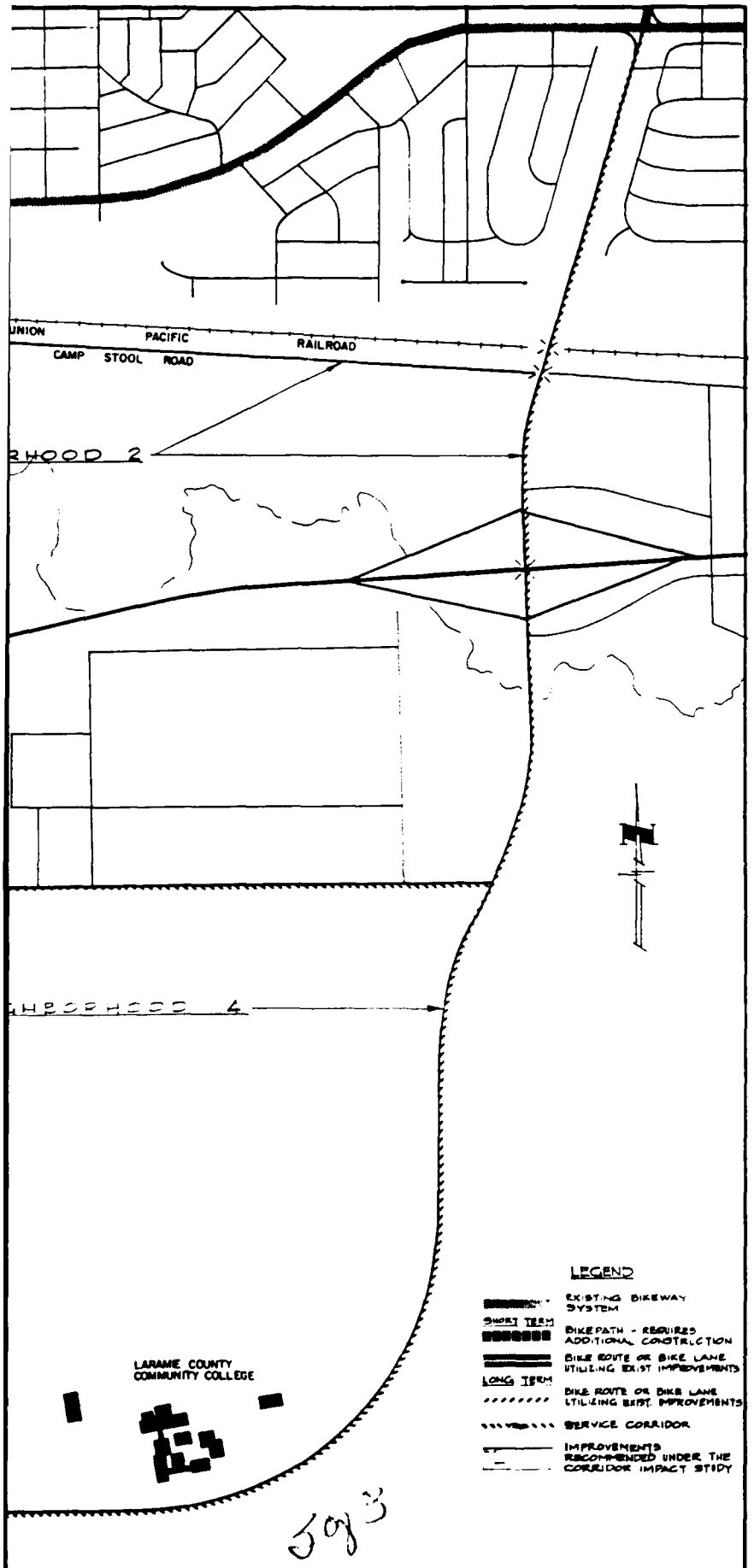
PROJECT NO.	84188.00

SOUTH CHEYENNE BIKEWAY/PEDESTRIAN P

PROPOSED BIKEWAY SYST



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PROJECT NO 84188.00

CHEYENNE BICYCLE/PEDESTRIAN PLAN

PROPOSED BIKEWAY SYSTEM

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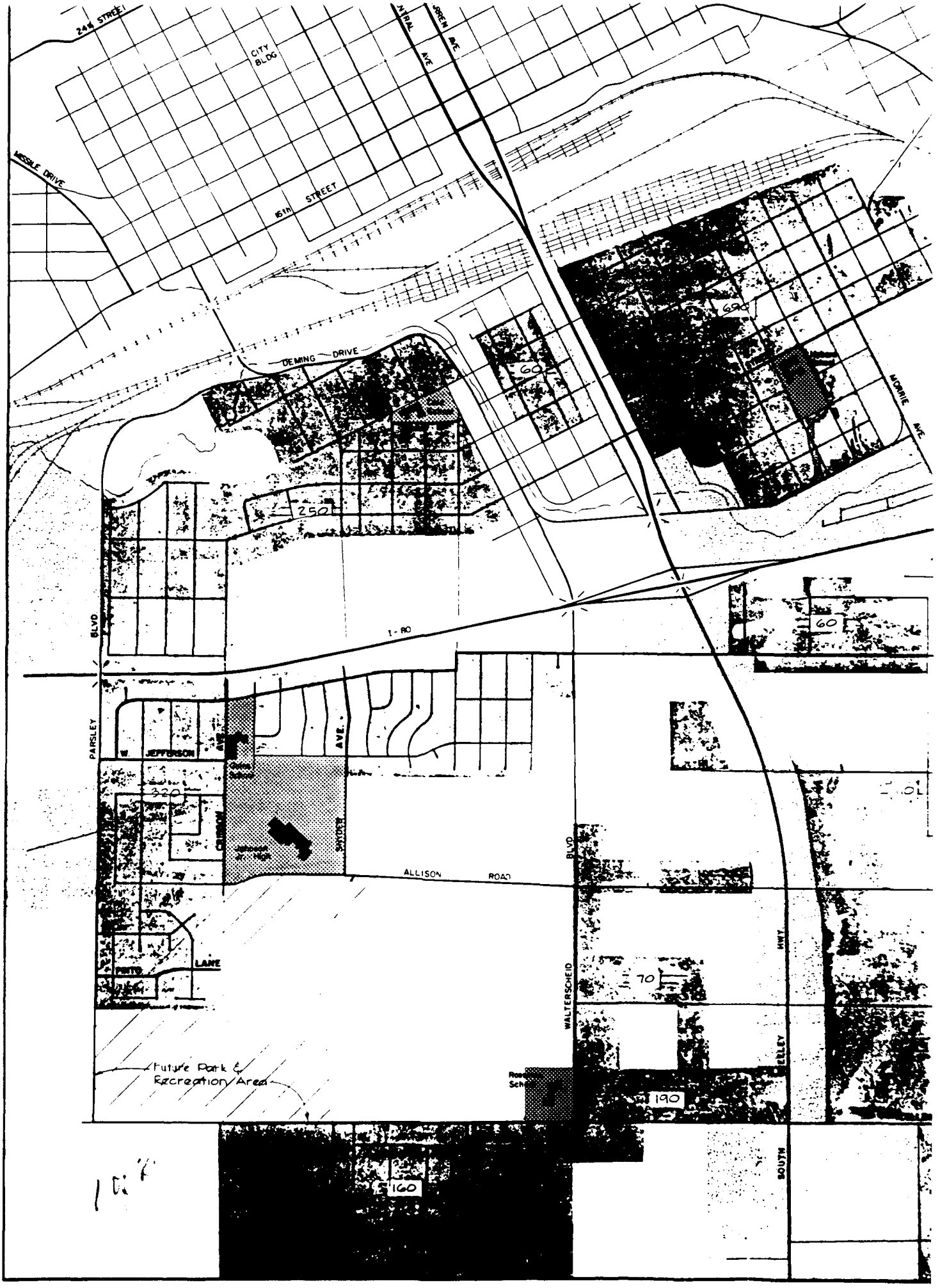
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BLVD
I-80
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PARSLEY
W. JEFFERSON
AVE.
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HWY
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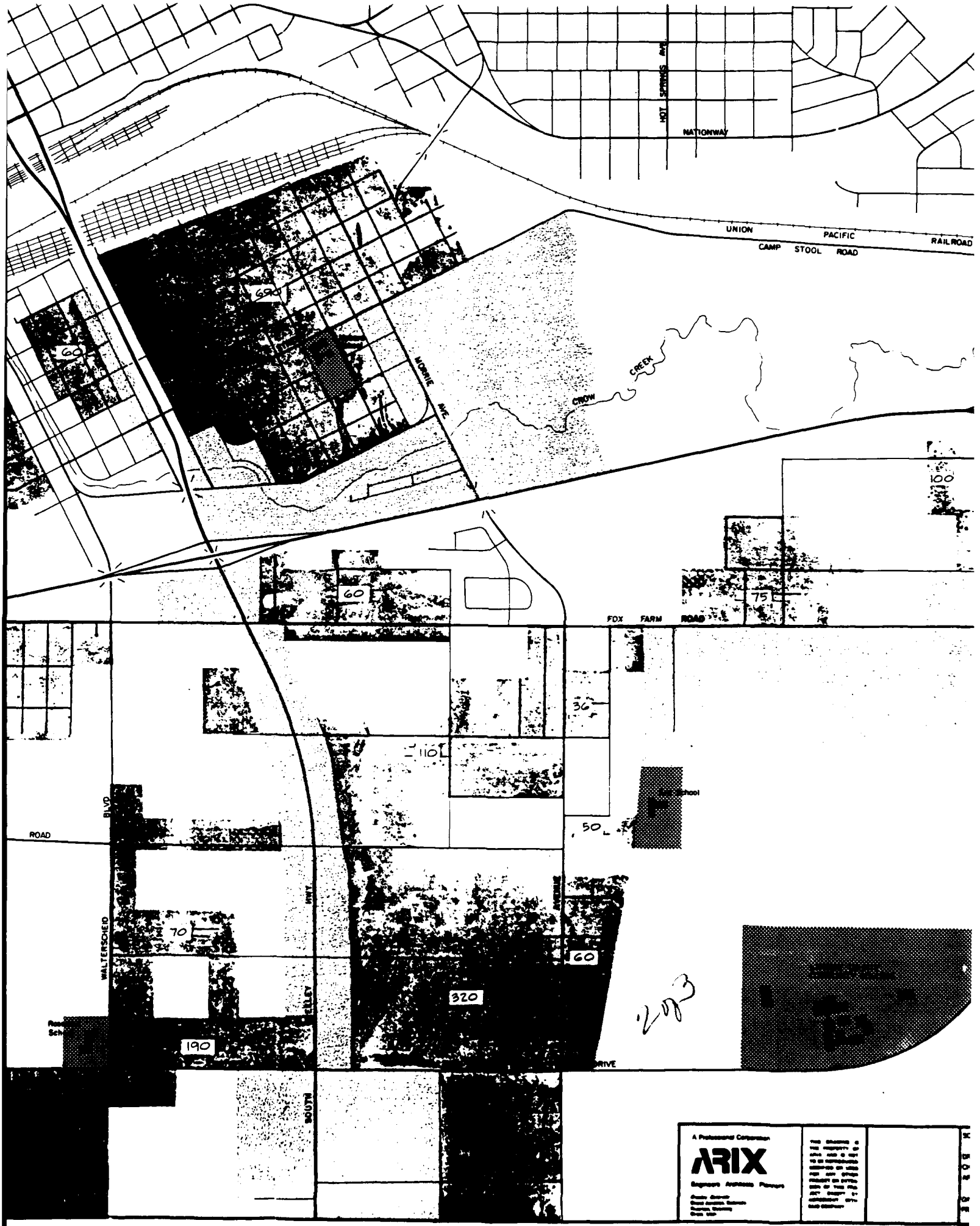
Future Park & Recreation Area
190
160
SOUTH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NATIONWAY
UNION PACIFIC RAILROAD
CAMP STOOL ROAD
CROW CREEK
MOBILE AVE
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100
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36
110
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ROAD
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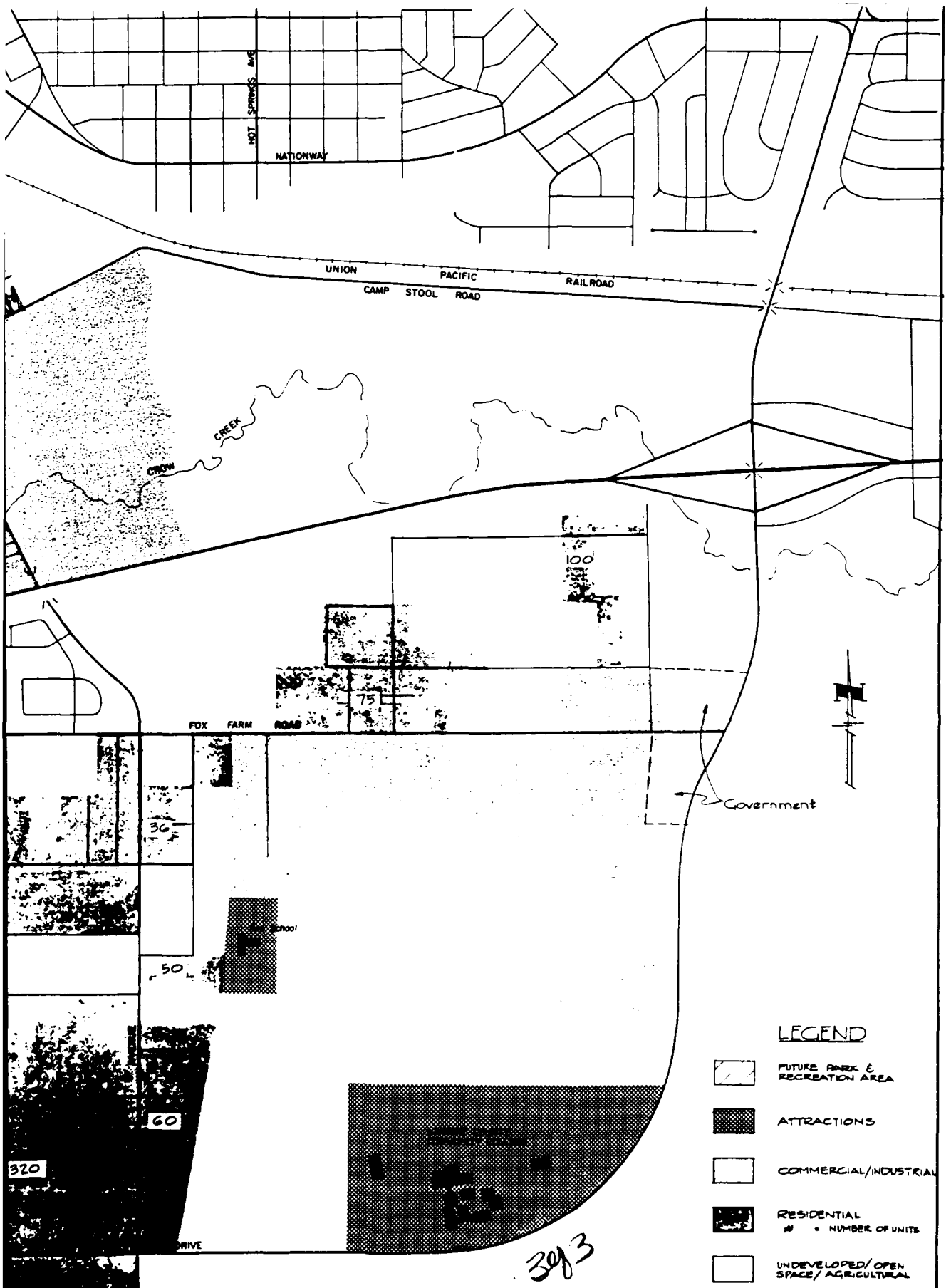

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PROJECT NO 84188.00

SOUTH CHEYENNE BIKEWAY/PEDESTRIAN PLAN

EXISTING LAND USES

2

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